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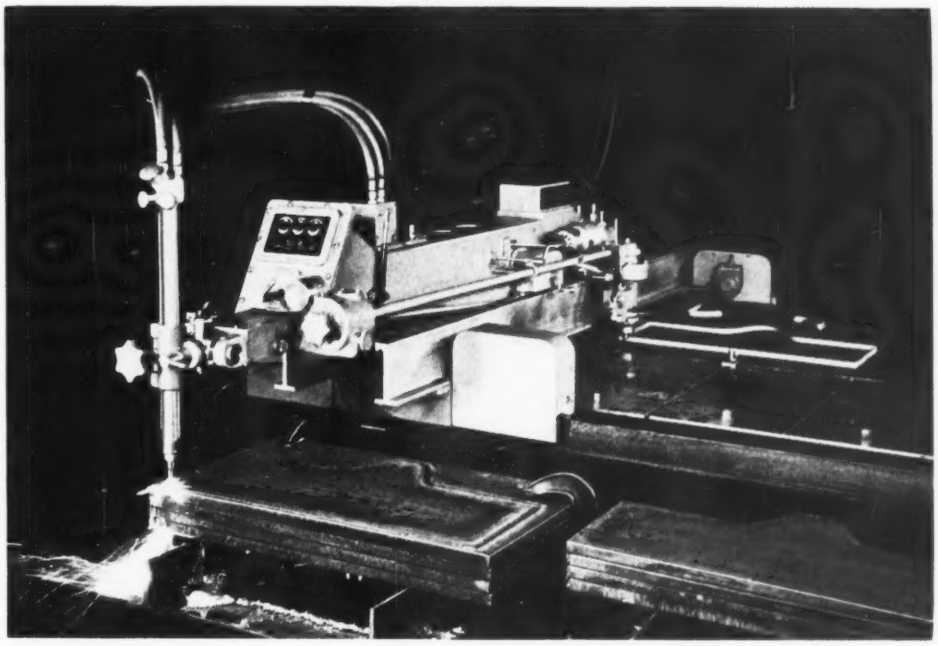
Stack-Cutting—A Newly Developed Flame-Cutting Process



Both Simple and Intricate Shapes are Readily Produced in Large Quantities by Oxy-Acetylene Machine-Cutting of Plates Stacked in Piles

By **D. E. ROBERTS**, Engineer
The Linde Air Products Company, New York

QUANTITY production of parts flame-cut from relatively thin steel plate by oxy-acetylene cutting machines is greatly facilitated by the use of a method that involves piling a number of plates one on top of the other, clamping them tightly together, and making the cut as if the clamped plates were one piece of solid metal. This process, known as "stack-cutting," has made possible the cutting of thin sheets and has resulted in an increase in the production capacity of the oxy-acetylene cutting machine, greater uniformity of the shape-cut parts, and a lowered unit cost of production. Stack-cutting has definitely placed oxy-acetylene machine-cutting in the class of mass-production operations.

With the constant improvement in the accuracy of cutting-machine and blowpipe operation, and with a steadily increasing number of well trained cutting-machine operators, more and more manufacturers are adopting the oxy-acetylene cutting process as an important step in their production work. Most large manufacturing organizations today require machinery that can repeat a particular production function over and over again. The oxy-acetylene cutting machine has already met this requirement through the development of the auto-

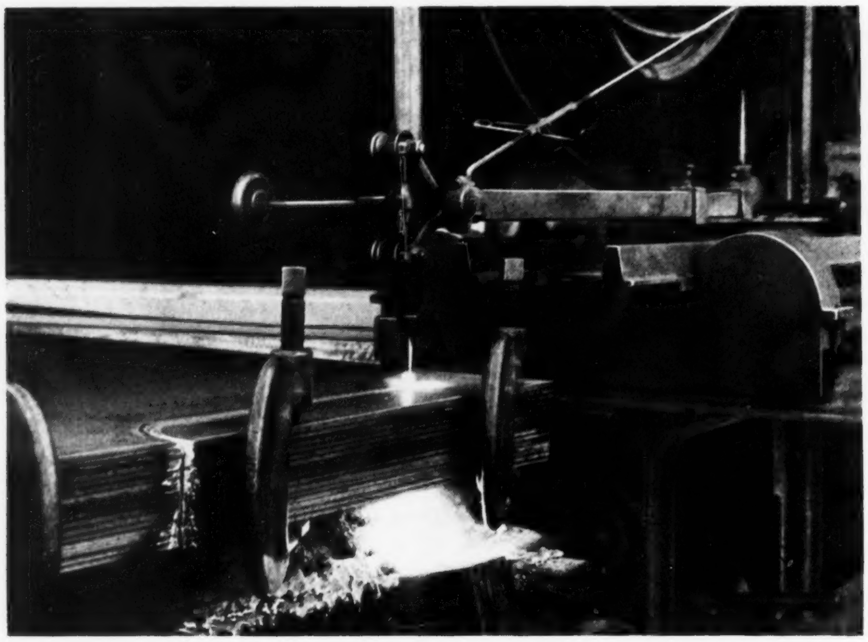


Fig. 1. Fifteen Plates, Each 1/4 Inch Thick, are being Cut Simultaneously into Parts for Railroad Coal Cars

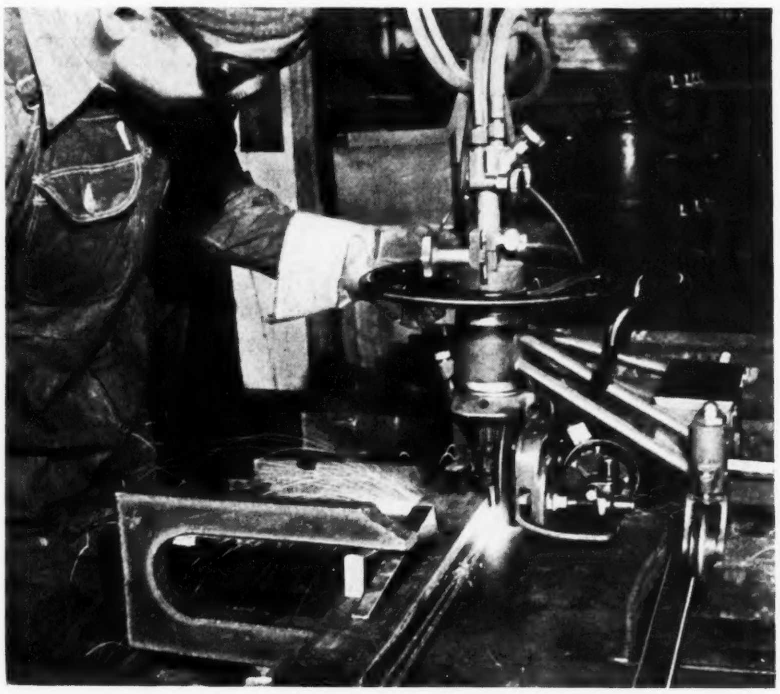
matic tracing device, whereby the machine can follow a full-size templet and reproduce an unlimited number of shape-cut parts. Stack-cutting now further increases the productive capacity of the cutting machine by making possible the shaping of several identical parts in one operation.

The success of stack-cutting is due to the fact that, when properly clamped together, several plates or sheets can be cut like one solid piece of steel. As in the flame-cutting of a single plate, the drive wheel of the cutting machine can be guided by hand or made to follow a templet automatically. Under proper operating conditions, the surface of the cut edges on all the stacked plates is left smooth and even, so that further machining is reduced to a minimum, and frequently eliminated, especially if the edges of the sheets are to be welded later.

The stack thickness will depend somewhat on the quality and accuracy of the cut desired. Stacks with an over-all thickness not greater than 2 inches can be cut with an edge tolerance of 1/32 inch, when the operating conditions are correct, while stacks from 2 to 4 inches in over-all thickness can be cut with an edge tolerance of 1/16 inch. If extremely close tolerances are not required, it is generally more economical to use a larger stack, since the cost of setting up the smaller stack is only slightly less, and hence the labor cost per cut piece is higher.

In general, for plate of moderate thickness, it has been found that the best results are obtained on a stack of plates or sheets about 3 to 4 inches in thickness, although stacks of greater thicknesses can readily be cut. The accuracy of this type of

Fig. 2. Furnace Parts from 16-gage Metal are Stack-cut with a Portable Oxy-acetylene Cutting Machine while Held Down by Wedge Type U-clamps



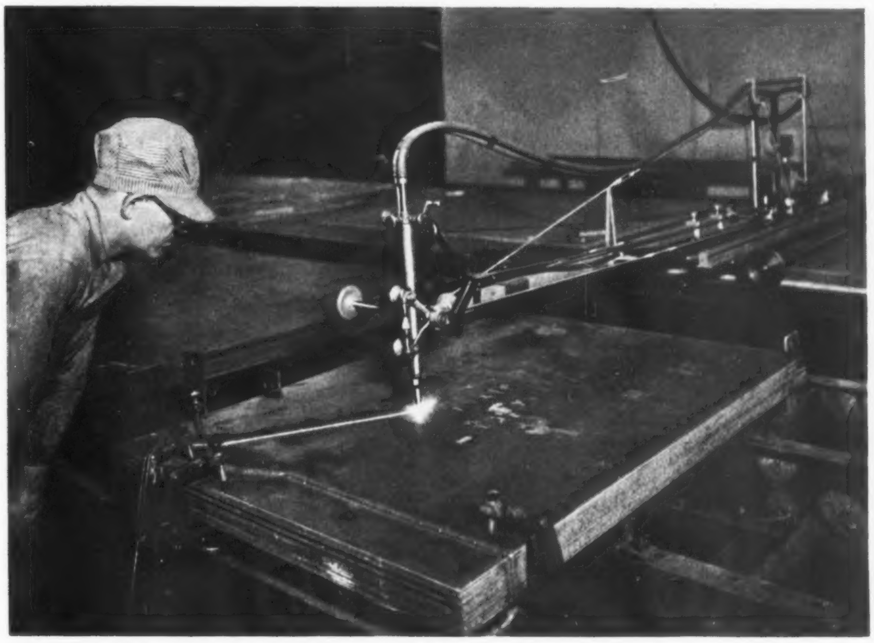


Fig. 3. Quick-acting Toggle Clamps Used to Hold Twelve 1/4-inch Plates for Flame-cutting Coal-car Hopper Sheets

cutting depends to some extent on the tightness with which the stack is clamped; with stacks thicker than 4 inches, the accuracy diminishes somewhat, due to the difficulty of obtaining a tight clamping.

On the other hand, a small stack is generally used when stack-cutting light-gage metal, so as to prevent burning of the top sheet with the large preheating flame which would be necessary for a thick stack, and also to prevent fusing of the sheets together by the greater heat. One firm in the Middle West is now successfully cutting, in production, twenty-four sheets of 16-gage material. The top sheet is unaffected in this operation, because the stack is tightly clamped with wedge type clamps, and a 1/4-inch pressure member piece is used along the line of the cut.

Clean plates greatly facilitate good results in stack-cutting. While a moderate amount of scale, dust, or dirt will not greatly affect the quality or cost of the operation, it is best to remove any foreign matter that might keep the sheets from being in close contact. Sheets up to 1/8 inch in thickness can usually be cut without cleaning each individual sheet, since the stacks of sheets, as they come from the mill, have usually settled together closely in transportation.

A little care will help keep plate material in good condition for stack-cutting. Plates or sheets should be stored indoors if possible, and kept free from moisture by piling them flat rather than in an upright position. In this way, only the top plate will be exposed. It is best to use the cleanest material available for stack-cutting.

Cleaning can be done in various ways. A blast of

Fig. 4. Compressed Air Clamps are Often Made Use of in Large Stack-cutting Set-ups, where Heavy Work Must be Handled with Efficiency

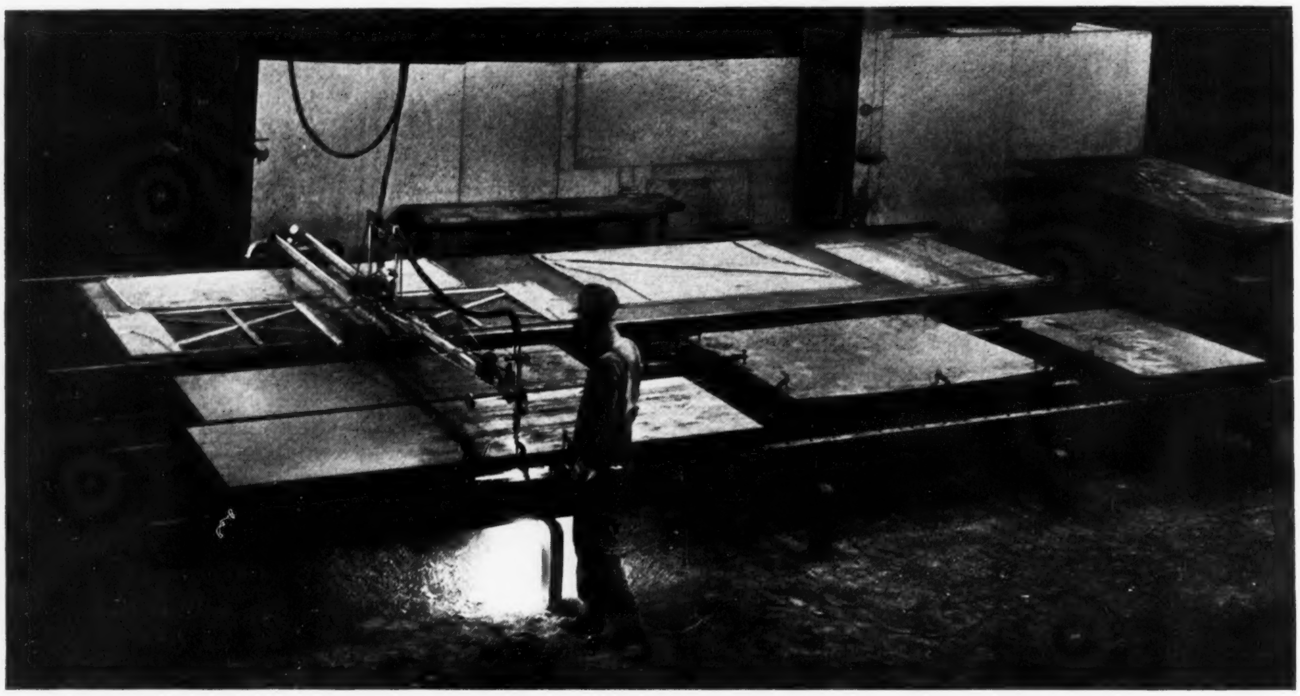


Fig. 5. Jigs and Templets are in Place, Ready for the Progressive Stack-cutting of Four Different Sets of Parts for Railroad Cars

compressed air is sometimes sufficient, and is readily used where air is the medium for actuating the clamping mechanism. If the sheets are not too large, the dirt can be rubbed off with a stiff brush or broom. For larger sheets, the removal of dirt with a brush may be necessary only along the line of the cut, since it is in this area that close contact between the plates is most essential. When very smooth and very accurate results are desired, however, complete scale removal is advisable. This can be accomplished by pickling or by sandblasting.

The next step is to remove entrapped air from between the plates, which is a relatively simple operation. The pile of plates is placed on the cutting table or trestle, and with a heavy machinist's hammer, the operator pounds along the line of the cut to be made, thereby squeezing out the air and eliminating any small depressions between the plates due to warping, bending, or slight variations in the thickness of the metal. If air or magnetic quick-acting clamps are to be used, they should be applied before the pounding is begun, and then reapplied several times in succession to get the stack down as tightly as possible. The other clamping arrangements should be applied and tightened as the pounding progresses.

Clamping Devices Used in Stack-Cutting

There are several methods of clamping in general use in stack-cutting. The choice depends upon the type of plate to be handled, the nature or shape of the cut, and the physical facilities at hand. The simplest type of clamp used in stack-cutting is the common C-clamp. Some of the other larger types are actuated by compressed air, hydraulic pressure, steam, or magnetic action. Bolting is preferred in some cases, while welding beads along the edges are used occasionally.

C-Clamps—Ordinary C-clamps are generally employed in the simpler types of stack-cutting operations, where such clamps can be easily applied and removed by the operator before and during the cutting operation. An example of this is in the cutting of small indentations in the edges of the sheets at the outside of the stack. (See Fig. 1.). Such clamps should be of substantial size, and a long leverage key should be used in tightening them, so that the stack will be pressed down tightly. The value of C-clamps is somewhat limited by their small pressure area and the inconvenience of turning the screw each time the clamp is applied or removed. For high-speed production cutting, therefore, a more substantial clamp should be used.

Wedge Type U-Clamps—This type of clamp is cheaper and speedier to use than any other kind. It consists of a U-shaped member cut from steel stock about 1 inch thick, the U-opening being about 1 inch larger than the usual stack of material to be cut in piled form. U-clamps can be used in conjunction with pressure member plates, shaped to the contour of the proposed cut. The purpose of the pressure members is to secure a uniform distribution of the pressure on the plates along the line of cut. The pressure member plate is laid on the stack with the contour about 1 inch from the line of cut. The U-clamps, which can be long enough to reach across fairly wide expanses of plate, are positioned along the line, and steel wedges are then driven in between the top of the U-member and the pressure member plate, thus pressing down the stack evenly along the line of cut. (See Fig. 2.)

Clamps of this type have been found to be very efficient, especially on light materials down to as thin as 16 gage. They can readily be fabricated from steel stock by means of a cutting machine; 1-inch steel stock is suitable for most stack-cutting operations. On heavier stacks and thicker plate, and where the cut is at a distance from the edge of the plate, thus requiring longer arms on the clamp, heavier stock would, of course, be more desirable.

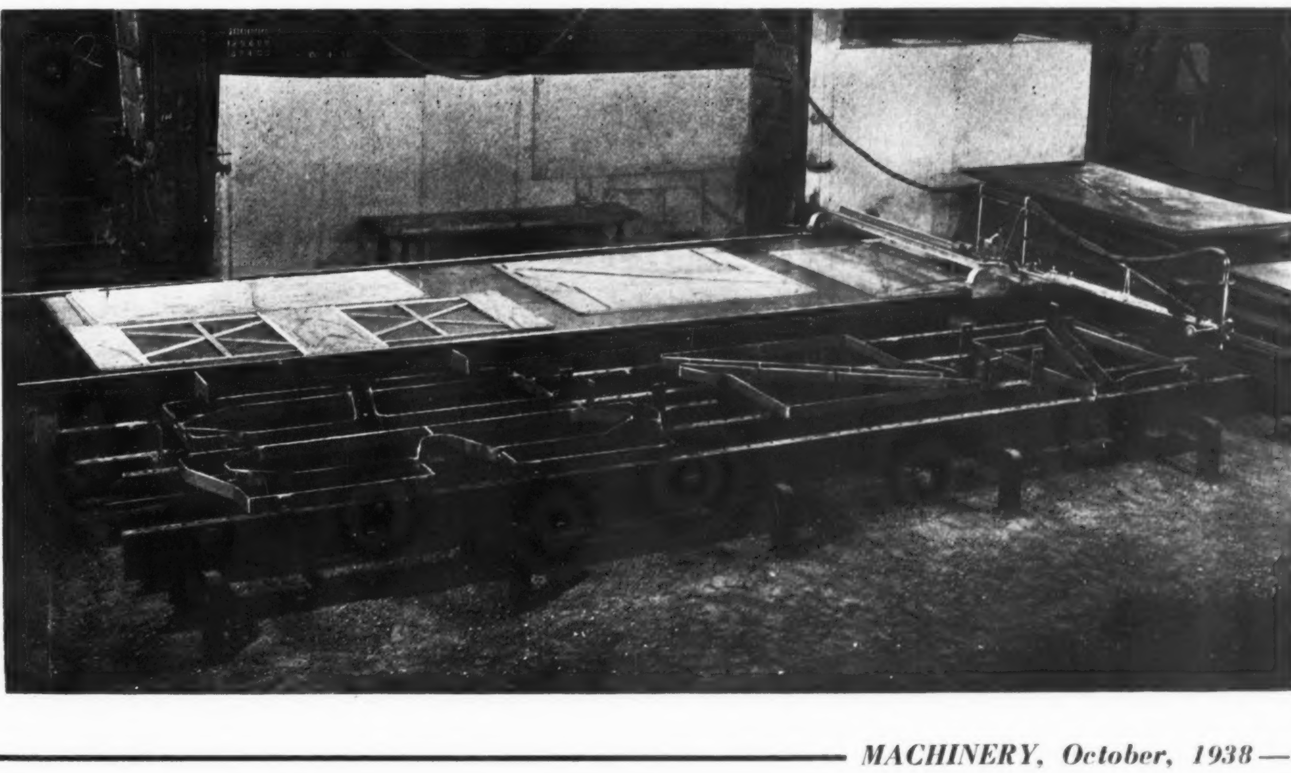
Toggle Clamps—Quick-action toggle clamps are useful, particularly when a long cut is to be made along an edge. The end is fitted with an adjustable turnscrew which permits effective clamping of various heights of stacks. For progressive cutting along the line, several of these clamps are put into position. The cut is started, and just as the blowpipe is approaching, the clamp is detached with one pull, and placed in position again just in back of the blowpipe nozzle. (See Fig. 3.) The next clamp is moved in a similar way, and this procedure is followed until the cut is finished. It is sometimes helpful to get additional leverage on these clamps by means of an auxiliary handle, in order to get a tight stack.

Air Clamps—Where the stock used in stack-cutting is large and heavy, and where the cutting operations are repeated many times with only minor variations in shape or size of the plates used, permanent air clamps are frequently found economical. In one fabricating shop, an ingenious clamping arrangement is actuated by a set of air-brake cylinders which were removed from an obsolete freight car. The cylinder piston pushes out an arm which swings a connected bar around to press down on the stack. (See Fig. 4.) These bars are simply steel forms, cut in the shape of an L from 1-inch or 1 1/2-inch steel, with slots cut in the back end of each, so that they can be fitted tightly on the square arm, and so that any torsion on the arm will press them down on the stack. Several bars can be placed on the square arm at one time and moved along to the desired position. The arms of these bars which apply pressure to the top of the stack can be of any desired length, so that they will not interfere with the line of cut. Pressure can be applied directly to the line of cut, or pressure member plates can be used to secure a more uniform distribution of the pressure along the line of cut.

Magnetic Clamps—Powerful electromagnets can be used to hold the plates down in position, especially when stack-cutting large circles. Care must be taken to see that slag and sparks from the cutting operation do not damage the magnet mechanism if it is mounted under the cutting table. Magnets can also be used to actuate cylinders in the quick-action clamps of the type described previously, but they are not so effective as compressed air, steam, or hydraulic pressure.

Welding Beads — In shops where heavy power presses of large size are available, it has been found effective, particularly when working with stacks of small plates where the cutting is done near the edge, to hold the stack together by means of welding beads applied while the stack is held in the power press. These beads can be made very quickly along edges of the plates that are not to be finished or are to be part of the discarded scrap metal. After the beads are laid on, the stack is moved by crane to the cutting table and the stack-cutting is performed. The beads are then "washed off" with a low-velocity cutting nozzle, or they may be left to hold the scrap together. This is an economical and

Fig. 6. The Loading of Sheets into Correct Position is Speeded up by Using Removable Stop-Keys, which Locate Each Stack



effective method of clamping, but cannot be used on very wide plate, because of a certain amount of unavoidable buckling in the middle.

Bolts—Some fabricators use simple bolting arrangements for the stack-cutting of parts that require bolt holes in later stages of fabrication or where hand-holes, man-holes, rivet holes, baffle-plate openings, or similar structural details are so located as to permit a bolt to be passed through the body of the piled plates. The stack of plates is simply held together with heavy erecting bolts while cutting is in progress. Plates of heavy steel with one or two bolt holes are used to stretch across hand-holes or other wide openings in the stack to prevent buckling in large plates.

This method of clamping is used by one manufacturer in stack-cutting excavating machinery plates which are fabricated with bolts and rivet holes. The holes are punched or drilled first, and a heavy bolt is inserted through the stack and tightened up to hold the plates tightly together for the cutting operation. Where specifications require an opening of large diameter in the body of the plate, as well as shape-cutting of the outside edges, the inner openings are stack-cut first, using C-clamps or wedge type clamps. Then plates with bolt holes in them are put across the openings, top and bottom, and bolts inserted. The stack can thus be tightened and the cutting done efficiently and quickly.

Methods of Plate Separation

The combined heat from the preheating flames and the cutting action sometimes results in a slight adherence between the cut sheets. If correct operating conditions have been employed, the separation of the plates will present no particular difficulties. On thin sheets, some grinding may be required, especially where the cut is continuous. One firm, engaged in stack-cutting 26-gage material, has found that a light grind after cutting is the most practical means of separating the sheets. Where the sheets are eventually going to be welded, or where the steel composition is such that quenching will not produce objectionable hardness, it has been found that a jet of water playing on the kerf behind the blowpipe, or immediate quenching of the cut section in water, will cause thin sheets to separate immediately upon release of the clamps.

Plates of 10 gage or heavier will generally separate when subjected to impact, such as being dropped to the floor or struck with a hammer. If the parts cut out are fairly long, one end of the stack can be picked up and rested on an elevation of some sort. The arc thus formed will cause the sheets to separate so that a pinch bar can be inserted, and further wedging apart can be accomplished with a 2- by 4-inch timber, if necessary.

Stack-Cutting in Heavy Production Work

Stack-cutting presents several outstanding advantages in the repetitive fabrication of large steel parts. An excellent example of this type of application is illustrated by the work being performed in railroad fabricating shops, where thousands of identical pieces are manufactured during the course of a regular heavy repair program. To meet such production demands, a cutting machine was installed in one shop with a cutting range of 81 inches transversely, and 24 feet longitudinally, sufficient to accommodate the progressive cutting of four different parts of large dimensions. A comparison of cost records after the cutting machine had been in operation for some time revealed an average saving over a fourteen-day period of 16 per cent in direct costs, as against doing this work by shearing methods. This comparison does not take into account any factors of overhead, such as maintenance of shearing machines and blades, nor power costs, nor does it include the savings effected through reducing the amount of material handling required when shearing was used. Further, it does not reflect the greater accuracy and quality of the flame-cut parts.

As all of the operations performed by the cutting machine may be repeated when required, permanent, full-size templets have been constructed which can be slipped into position almost instantly on the top of the cutting machine table by the guiding action of permanently located jigs and stops. This speedy method of fixing the proper position of the templet permits a rapid and economical change from one operation to another.

The stacks of sheets or plates to be cut are placed on jigs mounted upon channel section beams which extend the full length of the machine and are supported, in turn, upon the work support furnished with the cutting machine. (See Fig. 5.) The jigs are constructed of 3/8- by 3-inch steel bars in skeleton form, the outline being slightly smaller than the contour of the part to be cut, so as to provide clearance for the cutting stream and the slag from the oxy-acetylene cutting reaction. The sheets are loaded on the jigs one at a time. Any dirt or rough spots which might obstruct close contact between the sheets is carefully removed and sheets or plates having kinked or buckled edges are straightened before being placed in the stack.

The loading of sheets on the jigs is considerably speeded up by means of removable stop-keys (see Fig. 6) which definitely locate each stack of material in its proper position without any further adjustment. The stop-keys are held in place by slots permanently welded to the channel beam. Provision has been made to work various sizes of plate stock from the same keyways or slots by making offset keys either extending beyond or receding from the vertical edge of the keyway. All the keys or stops are identified by markings indicating the specific operation on which they are to be used and the location of the stop-slot in which they are to be placed. Thus a change of stop arrangement can be made rapidly, with no delay in the loading—an advantage of considerable importance.

The material is loaded progressively; that is, the jigs are filled starting at one end of the machine and proceeding to the jig at the opposite end. The

loading of the jigs continues, as does the unloading, while the cutting operation is being performed, and the entire operation becomes a complete and continuous cycle of loading, cutting, and unloading.

As soon as the loading is completed, pressure is applied by means of the clamping devices and the cutting operation is started, a single operator handling the machine. The cut is started at the edge of the stack against the gaging stop, and if continuous, is not interrupted until the cut is completed. In cases where the lines of cut intersect and stop at the point of intersection, gates or switches are provided in the templet. When the cut reaches the point of intersection, the cut is stopped until the gate can be moved into the proper position. The cut is then resumed by starting through the kerf at the point of intersection of the two lines of cut.

In an article to be published in a coming number of MACHINERY, additional applications of the stack-cutting method will be dealt with, such as the cutting of circular disks, the cutting of small intricate shapes, and the trimming of plates.

Simultaneous Use of Different Metal-Cutting Materials

By R. R. WEDDELL
The Ingersoll Milling Machine Co.
Rockford, Ill.

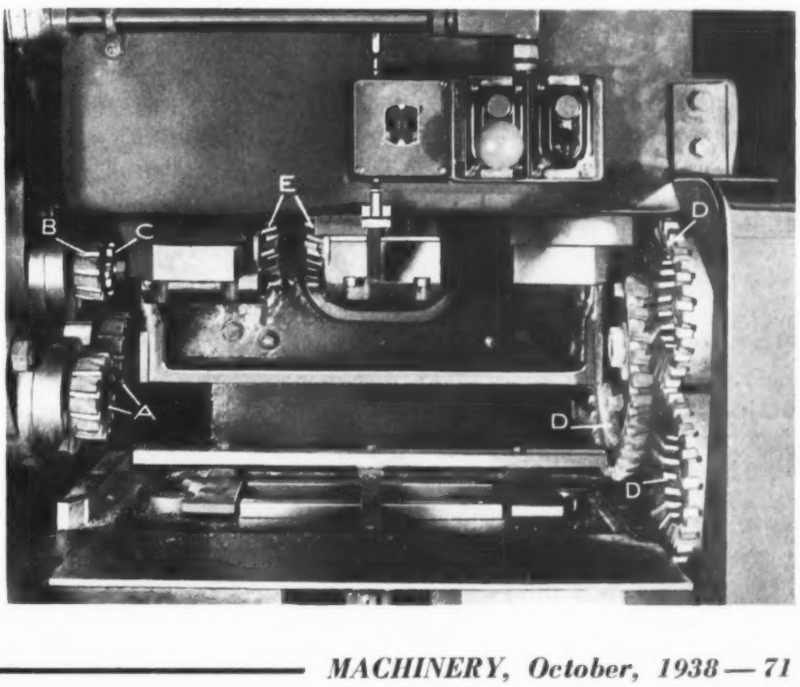
EACH different type of metal-cutting material offers certain advantages for specific operating conditions. No single material is a "cure-all." No one entirely supplants another. The well-known 18-4-1 high-speed steel is the most generally used of metal-cutting materials. This grade of steel is the most suitable for all-around cutting tool requirements.

Stellite, particularly J-Metal, has proved most advantageous in cutting hard semi-chilled cast surfaces. Its alloy content provides a cutting material that resists wear to a remarkable degree.

Cemented carbides, in various grades, are the hardest cutting materials known. Operating under rigidly prescribed conditions and on suitable equipment, the carbides will give unusually high production and show a long life in machining certain materials.

For longest life, each cutting material has its own best cutting speed in machining different materials. Sometimes it is just as economical to use a less expensive cutting material at slower speeds as a more expensive one at a higher speed. At other times, it is advantageous to use the more expensive cemented carbides which can be run at maximum speeds and have long life between grinds.

Occasionally, different cutting materials can be used on composite operations. Cutters of different diameters and materials can be used simultaneously—a small-diameter cutter of high-speed steel, and a large-diameter cutter of Stellite or carbides. The two cutters are mounted on the same spindle or



Milling Cylinder Blocks Using Simultaneously Cutters having High-speed Steel, Stellite, and Cemented-carbide Inserted Teeth

arbor and run at different cutting speeds, each suitable to their diameters.

Different cutting materials can also be used to balance required production times for different operations. The illustration shows how a special Ingersoll milling machine utilizes simultaneously cutters of three different materials for machining a cylinder block assembled with bearing caps.

The three-head, nine-spindle machine rough- and finish-mills the front and the rear ends of the cylinder block. It mills in one pass both sides of the thrust bearing, the outside of the rear bearing, the oil-slinger groove, and the oil-pump bosses inside the cylinder block.

The rear end of the block is machined by a rotary head carrying three spindles. Ingersoll Ray-blade cemented-carbide cutters shown at *A* are used for rough- and finish-milling, the head being arranged to feed a complete revolution after automatically moving into the cutting position. These 4 3/8-inch diameter cutters rotate at 154 revolutions per minute, or 180 feet per minute; the feed is 25 inches per minute, or 0.016 inch per tooth. The rotary head is mounted off center in a drum, and after feeding part of a revolution, the spindle carrying the rear bearing cutter *B* and oil-slinger groove cutter *C* performs its operations.

The rear bearing cutter *B* is another Ingersoll Ray-blade cutter, 3 1/4 inches in diameter, tipped with cemented carbide. It runs at 164 revolutions per minute, or 140 feet per minute, feeding at 19 inches per minute, or 0.014 inch per tooth. The oil-grooving cutter *C* is of solid Stellite, 2 3/4 inches in diameter. It machines the niche for the oil-groove. It rotates at 154 revolutions per minute, or 110 feet per minute. The circular feed is 9.6 inches per minute, or 0.006 inch per tooth.

The front end of the cylinder block is machined at the same time as the rear end, by the three-spindle traveling head unit shown at *D*. The feed is at the rate of 22 inches per minute. A pair of right- and left-hand 8-inch diameter Ray-blade cutters having J-Metal blades are interlocked together for rough-milling. The surface is finished by a single 15-inch diameter Ray-blade finishing cutter with J-Metal blades. The roughing cutters run at 95 feet per minute, with a feed of 0.024 inch per tooth. The finishing cutter, immediately following the roughers, rotates at a speed of 105 feet per minute, with a feed of 0.012 inch per tooth.

After both these units have completed the roughing part of their cut, a pair of Zee-Lock half side-milling cutters *E* with high-speed steel blades finish the thrust bearing. These 4 1/4-inch diameter cutters run at 54 revolutions per minute, or 60 feet per minute. A chip of 0.014 inch per tooth is taken at a 9-inch feed per minute. The cutters are carried in a vertical unit consisting of a three-spindle milling head, which also finishes the oil-pump pads in a single pass. The cutter for the latter operation (not shown) is also a Zee-Lock half side-milling cutter, 7 1/2 inches in diameter, with high-speed steel blades, running at 60 feet per minute, with a feed of 0.016 inch per tooth.

Thus, by the use of cutters of different materials, several operations are economically performed simultaneously. The production is at the rate of 27 blocks an hour.

Drilling Stainless Steel

By A. J. SNYDER, Engineer
Morse Twist Drill & Machine Co.
New Bedford, Mass.

IN drilling the 18-8 type of stainless steels, the high feeding pressure required, compared to that needed for ordinary steel, was noted. Because of this feeding pressure, it was deemed desirable to develop a specially heat-treated high-speed drill with a heavy web section. The Morse Twist Drill & Machine Co., New Bedford, Mass., has developed a line of such drills from No. 80 wire gage up to 1/2 inch in diameter.

Owing to the work-hardening characteristics of stainless steel, it is necessary to exert sufficient feeding pressure on the drill to keep it feeding all the time. A few revolutions of the drill without cutting will harden the surface of the material. It will then take considerable feeding pressure to make the drill cut again. The speed of the drill should be from about 45 to 50 peripheral feet per minute. A sulphur-base oil should be used as lubricant.

The drills referred to can also be used for drilling Monel metal and heat-treated materials with a hardness up to 400 Brinell. They can be used successfully in electric hand-drills, as they are designed to withstand greater torque stress than the regular conventional style of drill. Breakage is reduced to a minimum even when the drills are subjected to hard usage. In grinding the points, it is necessary to keep the web thinned at the point on the sizes from No. 50 to 1/2 inch.

Drills of this style will drill a depth of hole equivalent to from two to three times their diameter without backing the drill from the hole. They are not recommended for deep-hole drilling, however, owing to their having less chip clearance.

Cutters for Economical Milling

The Cost of Milling Depends on the Machine, the Fixture, and the Cutters. This Article Deals with the Third of These Factors, Giving Examples of Cutters Designed for Obtaining Successful Results

By W. D. AVERILL
Engineering Service Department
The Cincinnati Milling Machine Co.
Cincinnati, Ohio

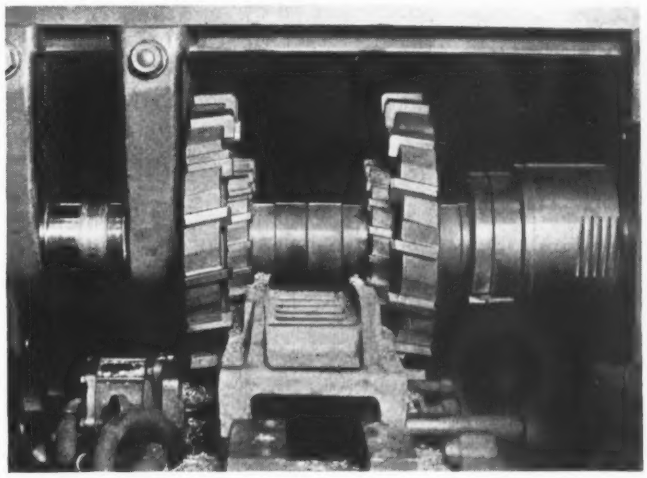


Fig. 1. Milling the Top and Two Sides of Cast-iron Cross-head Gibs for Steam Locomotives

THE success of a milling operation depends to a great extent upon three factors—the machine, the fixture, and the cutters. The cutters, although usually the least expensive of the three elements, do the actual work, and are, therefore, obviously just as important as the other two. Furthermore, the milling cutter cost, due to wear and occasional breakage, may be multiplied many times during the life of the machine and the fixture. Hence, it is possible for the total cost of cutters used on a milling machine during its life to exceed the cost of the machine. The cutter, therefore, is the key that makes it possible to obtain the full investment value of the machine.

The present article illustrates and describes a number of milling cutters designed to enable the maximum return to be obtained from machine and cutter investment. They are shown used on machines built by the Cincinnati Milling Machine Co.

Fig. 1 shows a plain Hydromatic milling machine equipped with an air-operated fixture and a special gang of half-side cutters for milling the top and two sides of cast-iron cross-head gibs for a steam locomotive. The smaller cutter mills with the face and periphery of the teeth, while the larger cuts with the face of the teeth only, much like the conventional face mill. Notice that the teeth on the smaller cutter extend below the face of the teeth on the larger cutter, assuring a sharp corner on the machined surface. The cutters have Stellite inserted blades and are 9 1/2 and 16 1/2 inches in diameter, respectively. The speed is 31 revolutions per minute; the feed is variable, but averages 6 1/8 inches per minute; the depth of the cut varies from 1/8

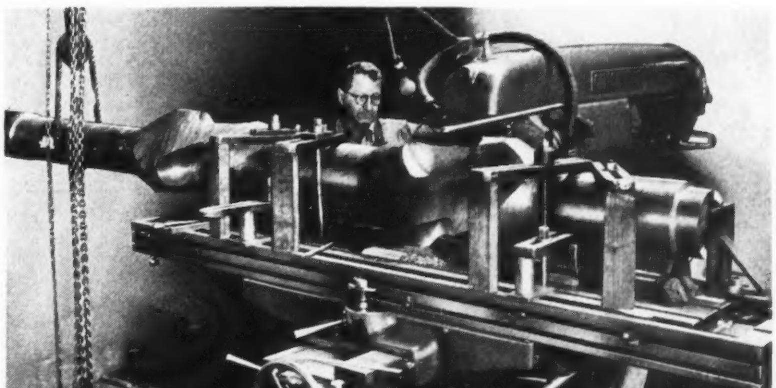


Fig. 2. Milling the Blade Seats in Huge Oil-well Reamers with a Half-round Spherical Cutter on a High-power Milling Machine

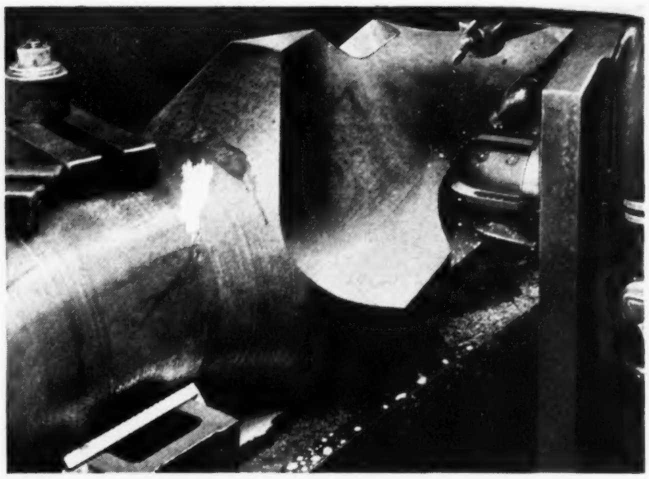


Fig. 3. Close-up View of the Milling Operation on Oil-well Reamers Illustrated in Fig. 2

to 3/16 inch; the production is approximately ten pieces an hour.

Figs. 2 and 3 show a set-up that requires a great deal of strength both in the machine and the cutter. A half-round spherical cutter mills the blade seats in oil-well reamers on a No. 5 plain high-power milling machine. The design of the cutter permits the work to be fed toward it to the proper depth, the operation being similar to that of drilling, and then the vertical and horizontal feeds are engaged simultaneously. These two feeds are geared to produce the required angle of 20 degrees from the horizontal. The cutter is an inserted-blade spherical end-mill 6 inches in diameter. The part being milled is a steel forging weighing approximately 5500 pounds. The maximum depth of the groove being milled is 4 5/8 inches.

An ingenious set-up that eliminates the usual burring operation following keyway milling is shown in Fig. 4. Here, a plain automatic milling machine is equipped with a fixture and cutter gangs for milling the keyways and beveling the corners of four shafts at the same time. Each gang consists of a slotting cutter, 2 inches in diameter, 0.171 inch wide, flanked by two 45-degree angular cutters, 1 3/4 inches in diameter. The angular cutters mill a small bevel at the top corners of the keyway, removing the burr that would ordinarily be left by the slotting cutter. The production is approximately 225 pieces per hour. The speed is 208 revolutions per minute, and the feed 8 3/4 inches. The cutters are made from high-speed steel.

An interesting cutter grinding attachment, mounted on a Cincinnati No. 2 cutter- and tool-grinder, is shown in Fig. 5. This attachment is used for sharpening form cutters on the periphery of the teeth (in contrast to the usual method of grinding the face of the teeth), thereby maintaining the original shape of the cutter. A supporting base is mounted directly on top of the machine table. On this base is a cross-slide, supported on ball bearings and guided in V-guideways. The cross movement of this slide toward or away from the grinding wheel is controlled by a cam bolted to its top surface. A spring extending through the fixed bracket holds the cross-slide and cam against the fixed follower stud. The longitudinal movement of the machine table is obtained by hand.

A form milling operation is illustrated in Fig. 6. In this instance, the cutter gang is made up of five solid interlocking sections having a total length of 11 inches and a diameter at the largest section of 8 1/2 inches. With these cutters, cast-iron impellers are finished complete at the rate of six an hour. In this instance, a high finish is required and the feed rate is held at 4 1/2 inches per minute, while the depth of cut varies from 1/8 to 3/16 inch. The cutting speeds vary from 82 feet per minute for the 8 1/2-inch-diameter section of the cutter to 44 feet per minute at the minimum diameter.

In modern production shops, rapid stock removal, as obtained in the majority of the examples shown, is one of the most important considerations. In general, as the power of the machine and the

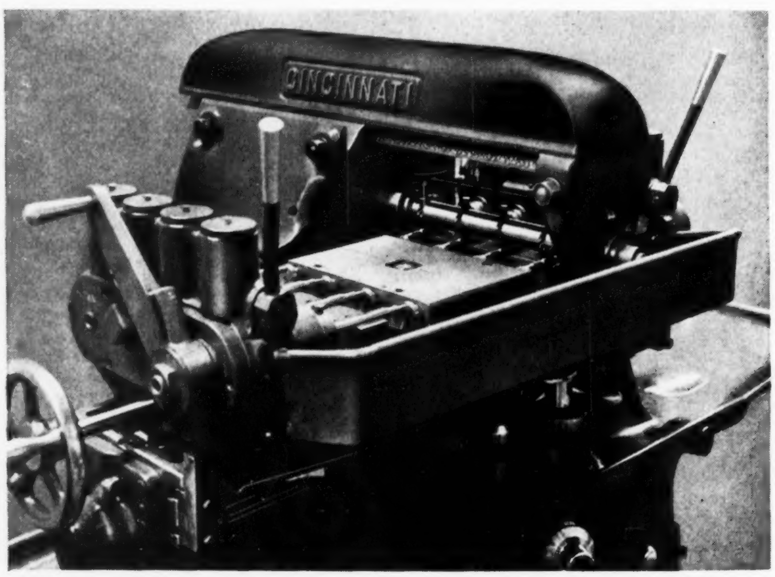


Fig. 4. Milling Keyways in Four Shafts and Removing the Burrs in the Same Operation

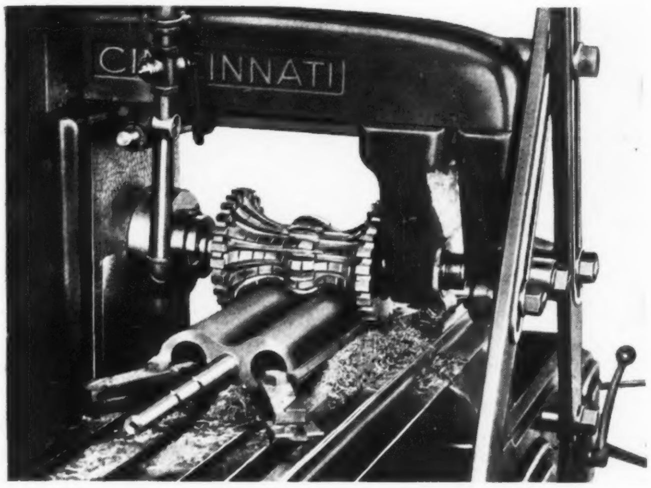


Fig. 6. Milling Cast-iron Impellers for Blowers with a Five-piece Interlocking Form Milling Cutter

strength of the work-holding fixtures can be made ample for the cut, the primary problem in obtaining the greatest milling efficiency is to design cutters that will withstand the cutting pressure, and at the same time permit a free flow of chips away from the cutting edge. The design must produce a strong tooth with the proper rake, primary and secondary clearance angles, and tooth gullets ample for the chips produced. Also, the material of the cutter must be so selected that it will stand up under the severe strain and heat conditions met with in continuous high-production milling. Each succeeding year brings improvements that enable industry to utilize more fully its production equipment.

* * *

Rubber and Plastics Meeting of the A.S.M.E.

At the fall meeting of the American Society of Mechanical Engineers, to be held at the Providence-Biltmore Hotel, Providence, R. I., October 5 to 7, a symposium on rubber will be presented by the Society's Committee on Rubber and Plastics. Two meetings will be held for the presentation of this symposium during the afternoons of October 5 and 6. The papers to be presented are as follows: "The Engineering History of Rubber," by Dr. W. C. Geer, Ithaca, N. Y.; "Synthetic Substances with Rubberlike Properties," by E. R. Bridgwater, E. I. du Pont de Nemours & Co., Wilmington, Del.; "Problems in the Production of Rubber," by E. G. Kimmich, Goodyear Tire & Rubber Co., Akron, Ohio; and "The Mechanical Characteristics of Rubber," by F. L. Haushalter, B. F. Goodrich Co., Akron, Ohio.

* * *

Problems Created by the Labor Act of 1938

A booklet entitled "Coming Problems Created by the Fair Labor Standards Act of 1938" has been published by Allen W. Rucker, in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. Copies of the booklet can be obtained by application to the Farrel-Birmingham Co. The conclusion of the authors with regard to the effect of the new Labor Act is that attempts on the part of the Federal government to raise the income of labor in some industries will be followed by corresponding reductions in the wage income of labor in other industries. This downward pressure, according to the authors, is likely to fall heaviest on the highly skilled workers and upon the heavy industries. In speaking of wage income reductions, the authors do not mean reductions in hourly pay, but reductions in annual income, due to reduced demand for labor in certain industry groups.

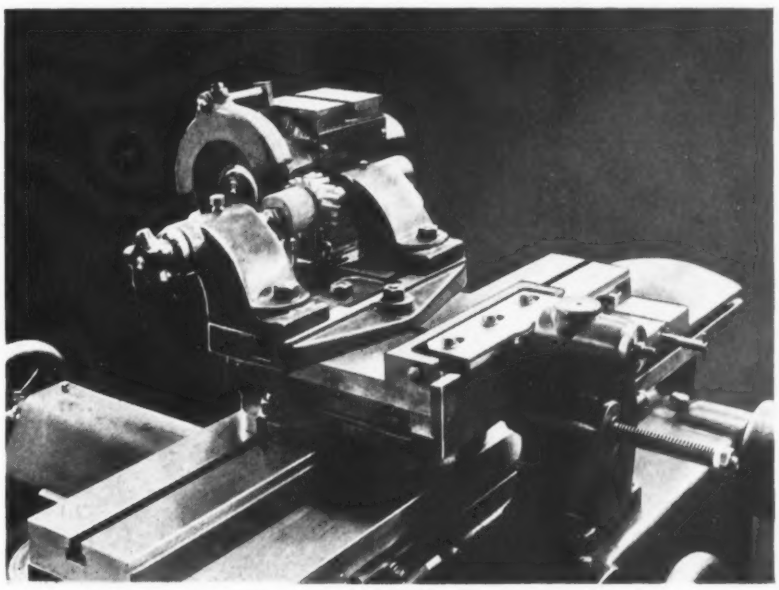
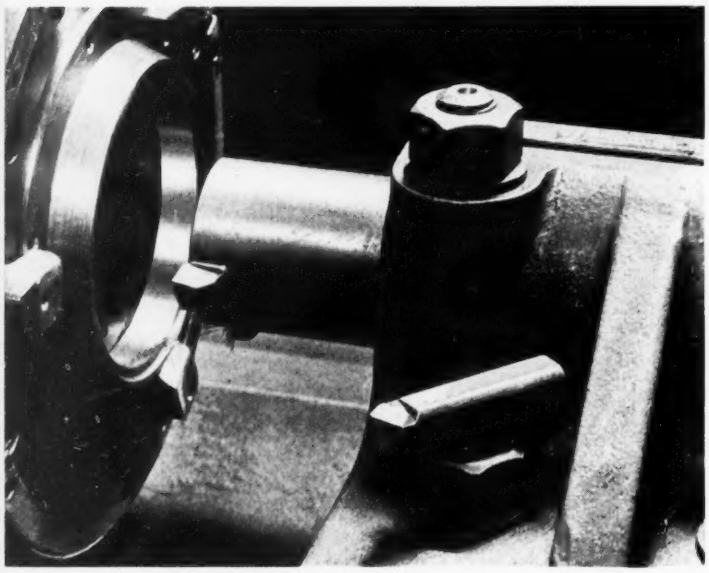
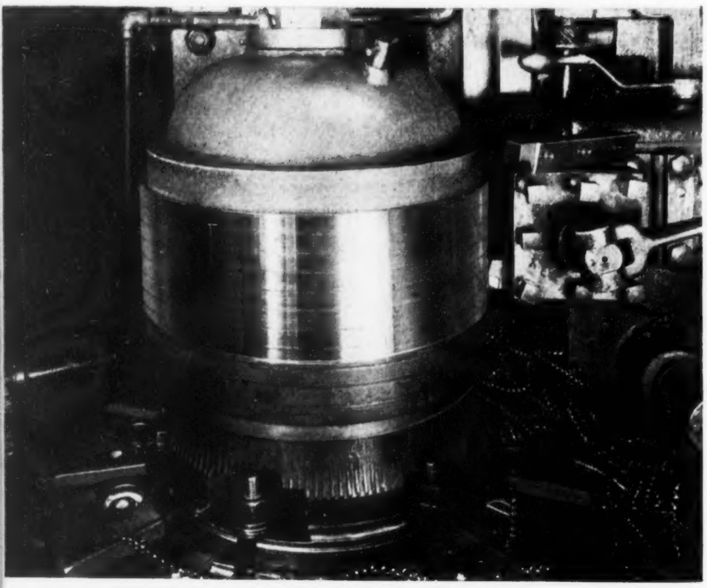


Fig. 5. Sharpening the Periphery of Form Milling Cutters by Use of a Special Attachment

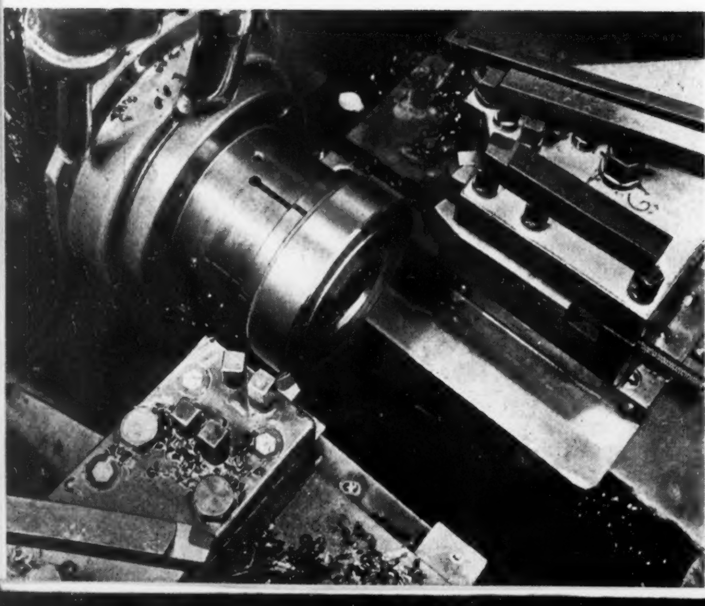
Tantalum-Carbide Tools



The Accompanying Illustrations Show a Selected Group of Operations in the Automatic Transmission Plant of the Buick Motor Co. Performed with Various Grades of Vascaloy-Ramet. To the Left is Shown the Finish-boring Operation on an Internal Gear of SAE 4640 Steel in a LeBlond Rapiduction Lathe Equipped with a Grade DW High Tantalum-carbide Tool. The Cutting Speed is 265 Feet per Minute, the Depth of Cut 0.015 Inch, and the Feed 0.010 Inch. The Tool is Resharpened Only after Every 350 Pieces. No Coolant is Used in This Operation.



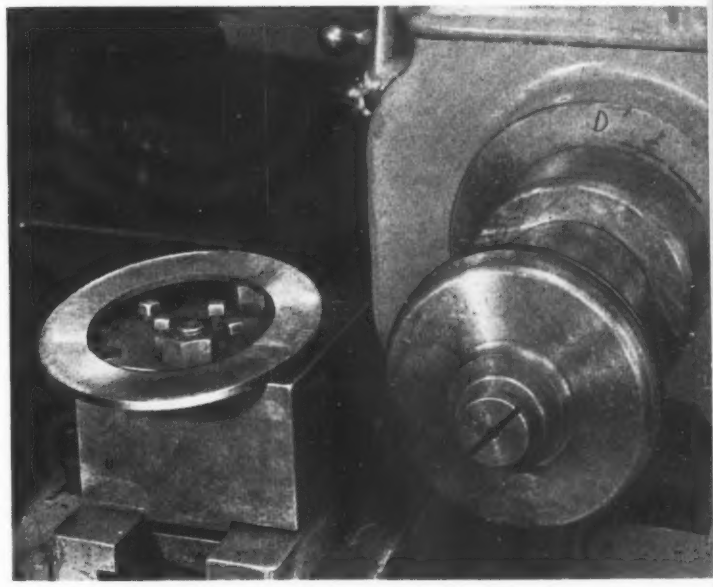
Turning Eleven Flywheel Ring Gears on a Bullard Vertical Turret Lathe. These Rings are SAE 1045 Steel and are Turned to 15.617 Inches Diameter at a Speed of 305 Feet per Minute. The Depth of Cut is 1/8 Inch and the Feed 0.027 Inch. Each Ring is 0.670 Inch Wide. The Cutting Time per Load of Eleven Gear Blanks is 3.5 Minutes. Twenty Loads, or 220 Gear Blanks, are Turned per Sharpening of the Grade E Cutter. The Chuck is of a Six-segment Design and is Expanded against the Inside of the Gear Blanks. A Heavy Cover Holds Them Solidly Together.



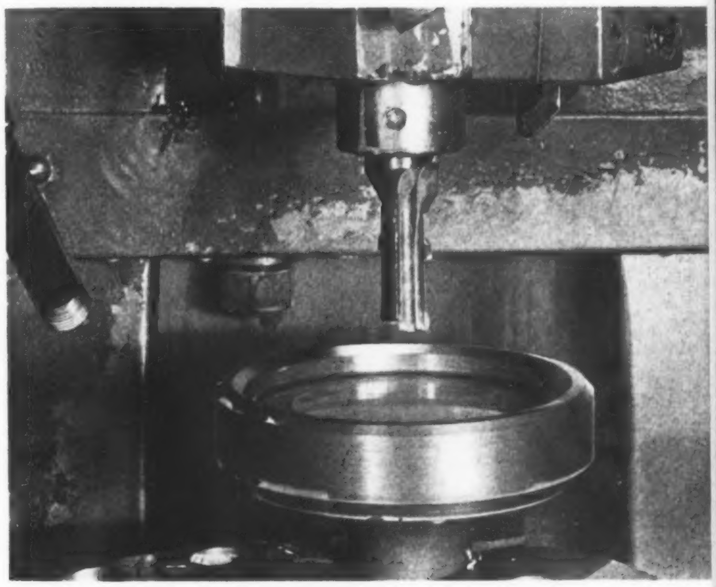
Turning the Outside Diameter of an Internal Gear of SAE 4640 Steel, and at the Same Time Facing Two Surfaces and Chamfering an Edge. This Operation is Performed in a Sundstrand Stub Lathe Equipped with Four Grade DT Tantalum-carbide Tools. The Turning Cut is Taken by a Tool on the Front Slide, and Three Other Cuts by Tools on the Rear Slide. Extra Tools Lying on the Slides Show how They are Ground. The Speed of the Turning Cut is 289 Feet per Minute, the Feed is 0.005 Inch, and the Depth of Cut is 1/32 Inch. The Average Production per Sharpening of the Tools is 150 Pieces. No Coolant is Used.

in the Buick Plant

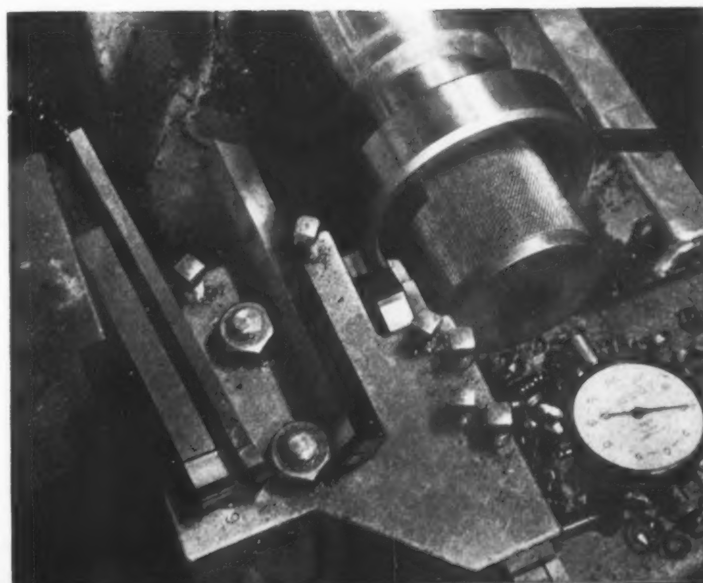
Thirty Clutch Plates of S A E 1070 Steel are Finish-turned in Each Operation in a LeBlond Rapiduction Lathe. The Cut is Taken at a Speed of 305 Feet per Minute; Depth of Cut, 3/64 Inch; and Feed, 0.017 Inch. A Grade DW Tantalum-carbide Tool is Used; 1000 Pieces are Turned per Sharpening of the Tool, which is Ground with a Chip Breaker of 28 Degrees. The Work-arbor is Air-operated to Clamp the Pieces by a Heavy Collar Assembled at the Front End. Only One Clutch Plate is Shown on the Arbor in the Illustration. No Coolant is Used.

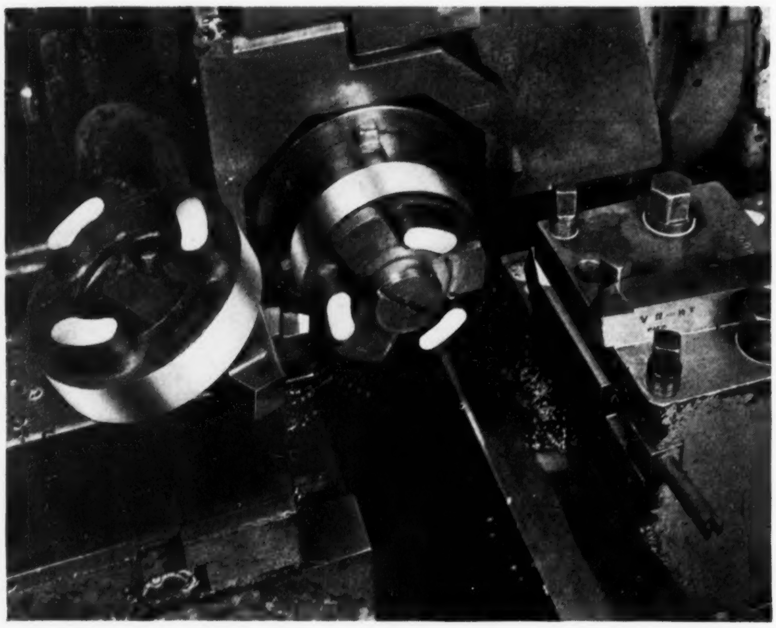


An Operation in which a Central Hole is Bored to Diameters of 0.740 and 0.790 Inch with High-speed Steel Tools at the Same Time that the Inside of the Rim is Chamfered with a Grade E Tantalum-carbide Tool at a Diameter of 4.429 Inches. The Chamfering Cut is Taken at a Speed of 340 Feet per Minute. Tantalum Carbide Enables all Cuts to be Taken Satisfactorily at Widely Different Speeds. The Machine is a Bullard Mult-Au-Matic, and the Part is an S A E 4640 Steel Forging; 800 Pieces are Chamfered per Grind, as Compared with Seven Pieces Formerly.

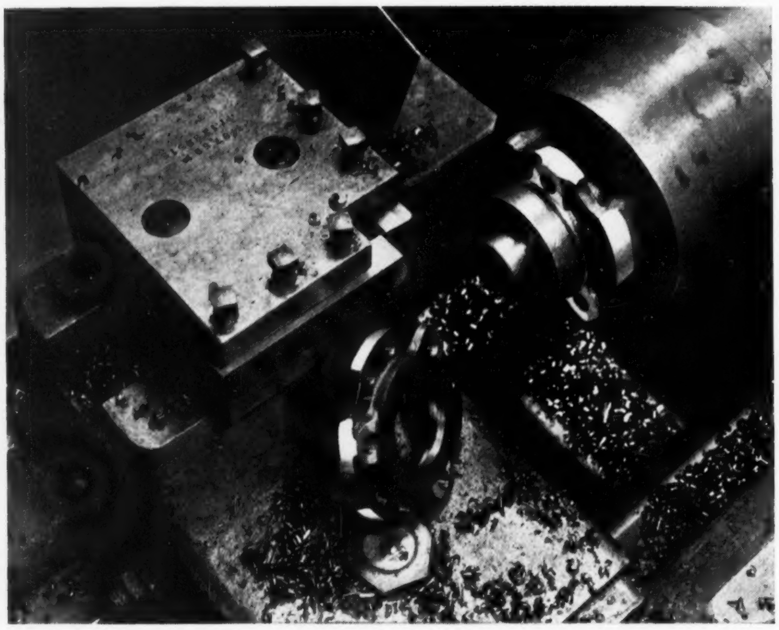


Internal Gears of S A E 4640 Steel are Finish-turned on the Outside Diameter, Finish-bored and Faced to a Stepped Surface in a LeBlond Rapiduction Lathe Equipped with Three Grade E Tantalum-carbide Tools. The Speed on the Circumference is 300 Feet per Minute, the Depth of Turning Cut is 0.020 Inch, and the Feed per Revolution is 0.013 Inch. Two Hundred and Fifty Pieces are Obtained per Sharpening of the Tools. The Indicator Provides a Means of Accurately Controlling the Width of the Work Piece in Taking the Facing Cuts by Coming in Contact with the End of the Work-arbor when the Tool-slide Feeds Forward.

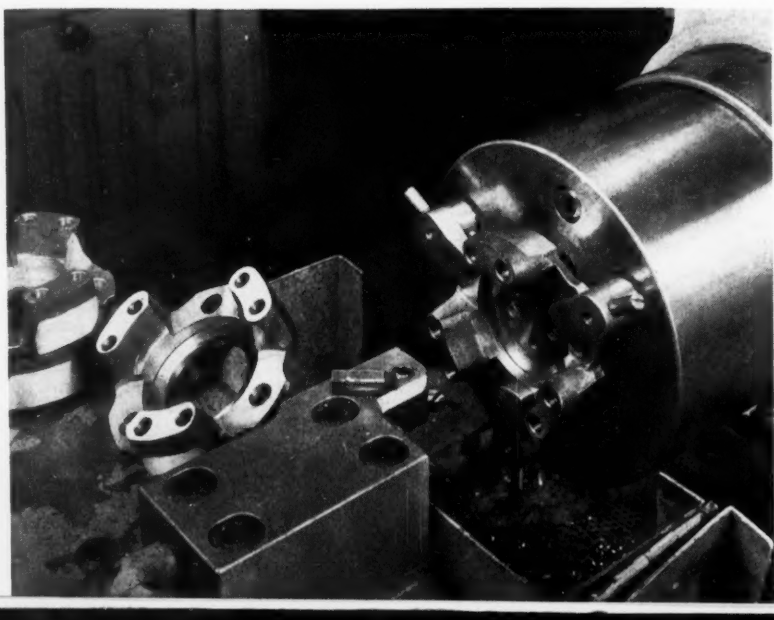




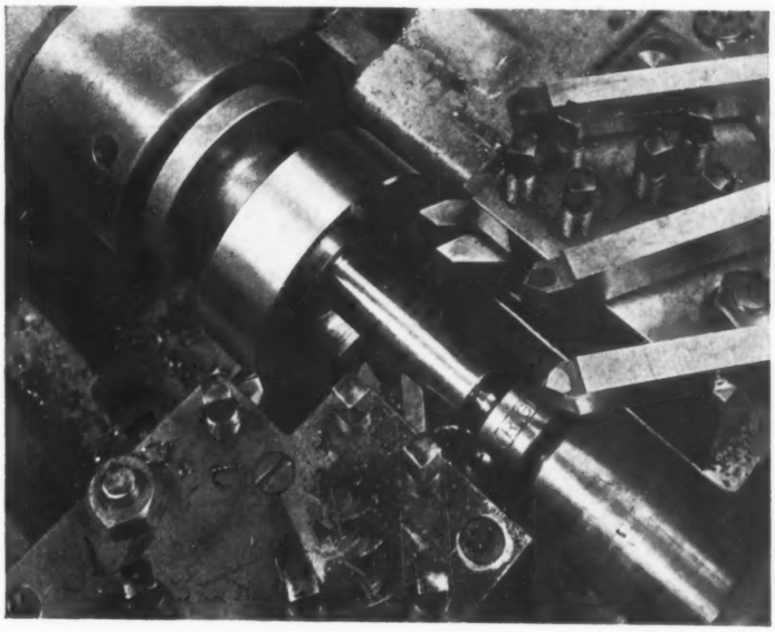
Intermittent Cuts are Taken by a Grade DT Tantalum-carbide Tool in Facing Three Bosses on a Clutch Hub. The Part is also Turned in This Operation by a Tool of the Same Grade, in a Sundstrand Stub Lathe. The Part is an S A E 1340 Steel Forging. The Intermittent Facing Cut is Taken at a Surface Speed Ranging from 156 to 221 Feet per Minute, the Depth of Facing Cut being from 1/8 to 5/32 Inch. The Turning Cut is Taken at a Speed of 262 Feet per Minute, the Depth of Cut being from 3/16 to 1/4 Inch. The Feed in Both Cuts is 0.003 Inch. The Turning Tool is Resharpened for Every 150 Pieces, and the Facing Tool for Every 22 to 40 Pieces.



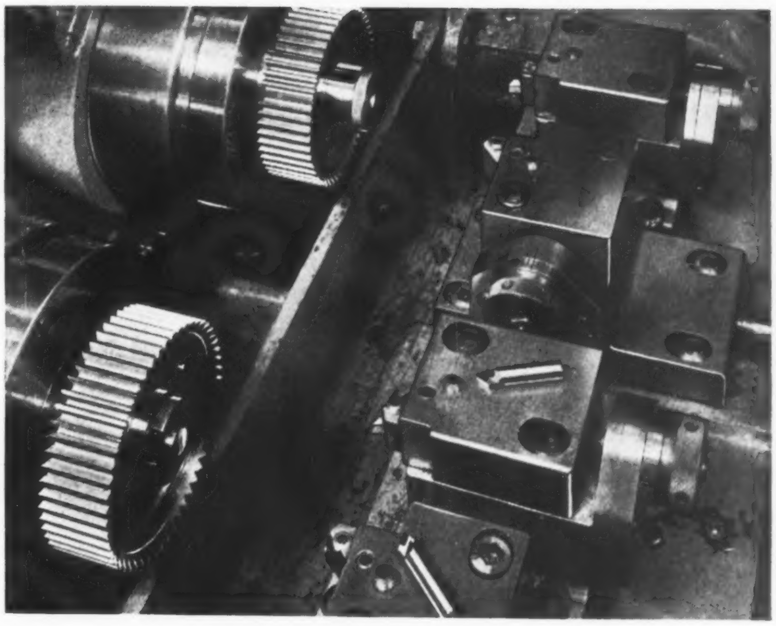
An Operation on a Planet Carrier in which Intermittent Cuts are Taken by Both Turning and Facing Tools. One of the Tools Faces Three Bosses and also Turns a Shoulder. The Other Tool Turns Six High Spots around the Periphery. The Peripheral Speed is 248 Feet per Minute, while the Speed of the Shoulder Turning Cut is 164 Feet per Minute. The Depth of Cut Varies from 1/16 to 1/8 Inch in Both Instances, and the Feed is 0.008 Inch. The Grade DT Tools Produce from 20 to 30 Parts between Sharpenings. This Part is also an S A E 1340 Steel Forging. In This Operation, Both Tools are Fed Longitudinally along the Machine Bed.



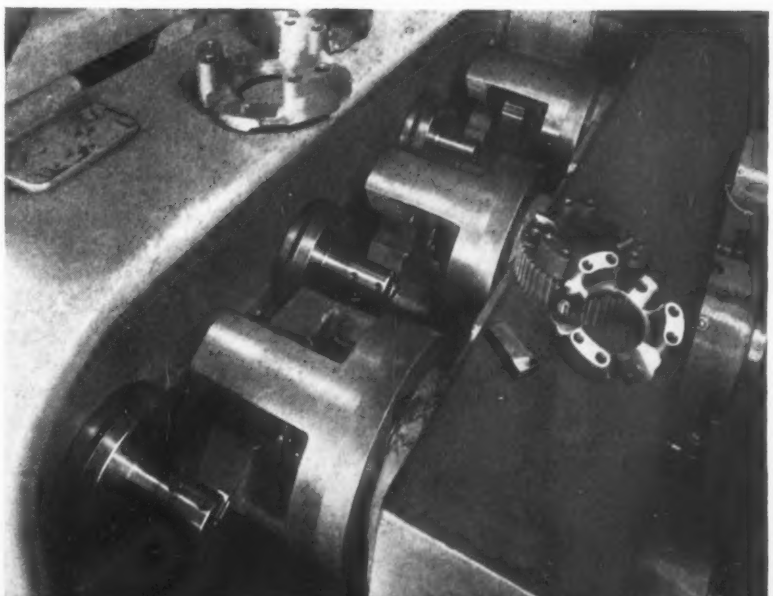
Precision-facing an Inner Thrust Face of a Planet Carrier in an Ex-Cell-O Machine. This Surface Must be Parallel with the Back Face on which the Part is Seated within Plus or Minus 0.0005 Inch. The Cut is 0.012 Inch Deep and is Taken at a Maximum Speed of 400 Feet per Minute, the Feed being 0.005 Inch. Seventy-five Pieces are Faced per Sharpening of the Grade DD Tantalum-carbide Tool. In This Operation, the Tool is Fed Longitudinally to the Required Depth and then Transversely toward the Back of the Machine until the Cut is Completed.



Three Tools on the Front Tool-slide of this LeBlond Rapiduction Lathe Finish-turn the Rim, Finish-turn the Hub and Chamfer the Bore of a Clutch Hub. At the Same Time, Three Tools on the Rear Slide Finish-face the Rim, Hub, and a Thrust Face. The Turning Cut at the Rim is Taken at 450 Feet per Minute by a Grade DD Tantalum-carbide Tool, all Other Cuts being Taken by Tools of Grade DW. With This Difference in Grades, a Production of 250 Pieces is Obtained per Sharpening of all Tools. The Part is Made of S A E 1340 Steel. Another Operation Identical to This, Except for Turning the Rim, is Performed on the Opposite Side by Another Machine.



Four Tools on this Double-head Ex-Cell-O Machine Take Cuts on Opposite Sides of the Clutch Hub. A Short Hub of the Part is Finish-turned and a Thrust Face Finished by Tools at the Front Station of the Machine, after which the Part is Turned End for End and Transferred to the Second Station, where a Long Hub is Finish-turned and a Second Thrust Face is Finished. The Facing Cuts are Taken at a Maximum Speed of 596 Feet per Minute and the Turning Cuts at 410 Feet per Minute; Depth of Cut, 0.015 Inch; Feed, 0.004 Inch. All Four Cutters are Grade DD Tantalum Carbide; 300 Pieces are Machined per Sharpening of Tools.



Three Thrust Faces on Pieces of Three Different Types are Faced with a High Degree of Precision on This Heald Triple-head Borematic. The Surfaces to be Faced are Located between Bosses. This Construction of the Pieces Necessitates that the Parts be Fed Sidewise to the Tools Three Times, and Indexed Prior to Each Feed Movement. The Tool-spindles are Run at 1080 Revolutions per Minute; Speed, 389 Feet per Minute. The Cut is 0.010 Inch Deep; the Feed is 0.005 Inch. From 35 to 40 Pieces are Finished per Sharpening of the Tools.

Finishing Microscopic Specimens

Detailed Information on the Abrasives Suitable for Preparation of Metal Specimens for Microscopic Study

By H. J. WILLS
The Carborundum Co., Niagara Falls, N. Y.

ONE of the least standardized of all lapping processes is that of finishing samples for microscopic examination and photomicrographs. Certain developments, the result of much research by The Carborundum Co., have, however, so improved the methods in common use that they may be offered as a standardized foundation for the process, especially in the metallographic field.

Before lapping or polishing a specimen, a smoothing operation is required, as the specimen is generally rough from a break or from a cutting-off operation. For smoothing, two general methods are available: (1) the use of grinding wheels, or (2) the use of a belt sanding machine.

1. When a bench or floor stand grinder is available, it is recommended that two wheels be employed, utilizing the wheel sides for leveling off the surface of the specimen. The wheels may be used dry, with little redressing, although water is preferred for the best results. The wheel gradings for this work are: For roughing, 100A-P-175 Aloxite Brand aluminum-oxide vitrified wheel; for finishing, 180A-P-175 Aloxite Brand aluminum-oxide vitrified wheel.

2. When an endless belt sanding machine is available, Aloxite Brand endless belts are recommended with KM splices (45 degrees). These belts are available in all widths and lengths for standard machines. For roughing, use 180X Aloxite Brand aluminum-oxide cloth; for finishing, 240X Aloxite Brand aluminum-oxide cloth.

For the next step after smoothing, three distinct methods may be used, employing, respectively, loose abrasives, wheels, or coated abrasive paper.

Loose abrasives in the form of powders or compounds are used in connection with rotating cast-iron disks covered with cloth, felt, or similar material. A survey of numerous laboratories indicates that the following practice is preferred:

Step	Covering
Rough-lap	Canvas
Semi-finish lap	Kersey, broadcloth
Polish (ordinary)	Kersey, broadcloth, or "Kitten's ear" velvet
Polish (high)	Chamois

The abrasives used vary considerably and depend largely upon the results desired and the available supply. In all cases, it is general practice to float the abrasive in water that is sometimes mechanically agitated to insure an even supply of grain to the disk. Recently, The Carborundum Co. developed a series of compounds for this application, the advantages claimed for which are mechanical suspension of the abrasive over long periods, free but shallow cutting without scratching, and controlled uniformity. These compounds are equally effective on all metals and on most ores or minerals. Besides these compounds, there are available several inexpensive abrasive powders which are well adapted to this class of work on most metallic specimens. The application of these compounds and powders is shown below:

Operation	Carborundum Brand Finishing Compound	Aloxite Brand Aluminum-Oxide Powders
Rough-lap	H46 Coarse	K5XM
Semi-finish	H46 Medium	H Fine
Polish	H46 Fine	Buffing Powder "A" Fine

A distinct advantage to be found in the use of abrasives in compound form is that they are not thrown from the disks. This feature alone makes the compound series H46 by far the most economical form of abrasive for specimen finishing.

The Selection of Polishing Wheels

There is a wide variety of specimens having surfaces that cannot be lapped level with loose abrasives, due to the variation of hard and soft portions. These are best finished to the point of polishing by the use of bonded wheels of special characteristics. With this method, the question of speed is important. If the specimens are to be finished dry, the wheel speed must be kept under 1500 surface feet per minute at the point of contact. If the specimens are ground wet, the speed may be as high as 5000 surface feet per minute.

Grinders especially built for the purpose, floor or bench stand grinders, or wheels in the form of disks fastened to the disks of conventional rotary disk finishing machines, especially if automatic in action, may be used. The following wheels are recommended for cast iron and non-ferrous metals, on any type of grinder:

1. Smoothing	80-10-C	Carborundum Brand Silicon-carbide Resinoid
2. Semi-finishing	220-12-C	
3. Finishing	500-14-C	

The following wheels should be used for most ores and steels:

1. Smoothing	180-10-K	Aloxite Brand Aluminum-oxide Resinoid
2. Semi-finishing	KHF-14-K	
3. Finishing	KHF-12-K	

for Laboratory Work

In polishing, the usual methods are followed. For some classes of work, as when the specimens are to be etched, polishing is not necessary after finishing with a wheel.

Laboratories preferring to use the dry method of finishing may find the following selection useful:

1. Smoothing	8/0 "Union" Pouncing Paper
2. Finishing	11/0 "Union" Pouncing Paper
3. Polishing	See paragraph relating to loose abrasives in the preceding.

The abrasive papers listed may be mounted on rotating disks or may be held flat on plate-glass while the specimen is moved back and forth by hand in one direction for a definite period of time and then at right angles to this direction. It is recommended that the coated sheets be rubbed over a corner before they are used, so as to level off the crystal coating.

Most laboratories use a conventional horizontal disk polishing machine. For such equipment, two abrasive disks are recommended, made for mounting on such machines. They are graded 180A-P-175 and KHF-14-K. They can be mounted simply by the use of a metal band, binding together the wheel and cast-iron plate at their peripheries. Naturally, the wheel diameter must be the same as that of the plate. It may be of any convenient thickness, but a thickness of 1 inch is recommended.

After the cut-off operation, the specimen is held in contact with the first wheel (180 grit), a small stream of water flowing on the center of the disk. After smoothing down with this disk, the specimen is transferred to the second or KHF grit disk, the work proceeding as with the first wheel. With careful manipulation, the specimen should now be ready to polish. This operation should be done on broadcloth, "Kitten's ear" velvet, or similar integument. First, wet the cover with water and then apply a small amount of Carborundum Brand finishing compound H46 medium. The results of the three steps in polishing are shown in the photomicrographs Figs. 1, 2, and 3, at a magnification of 95.

To keep the wheels truly flat, it is recommended that a block of cast iron be held momentarily against the face of the disk at frequent intervals. If the disk should become badly grooved through neglect, the wheels may be mounted on a lathe faceplate and trued up with a diamond in the toolholder.

Small laboratories still prefer to do the preliminary smoothing of specimens by hand. This is particularly true when the specimens have several layers of metal, as in plated wear. In this case, it is best to use a regular 9 by 14 sheet of "Union" plate pouncing paper in grit 8/0, followed by 11/0, after which the specimen is ready for polishing in the customary way.

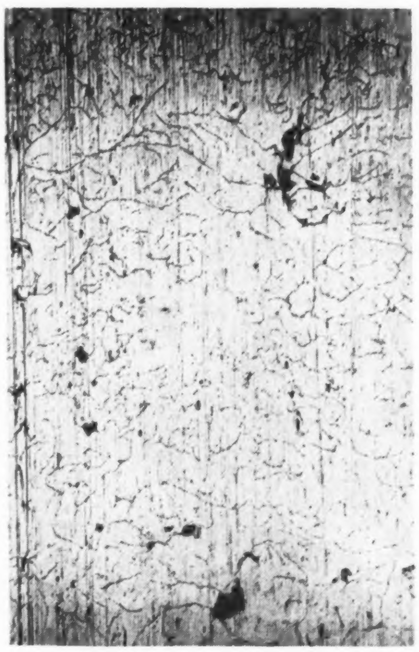


Fig. 1. Appearance of Specimen after having been Smoothed down with a 180-grit Wheel

Fig. 2. Specimen after having been Polished by the KHF Grit Wheel

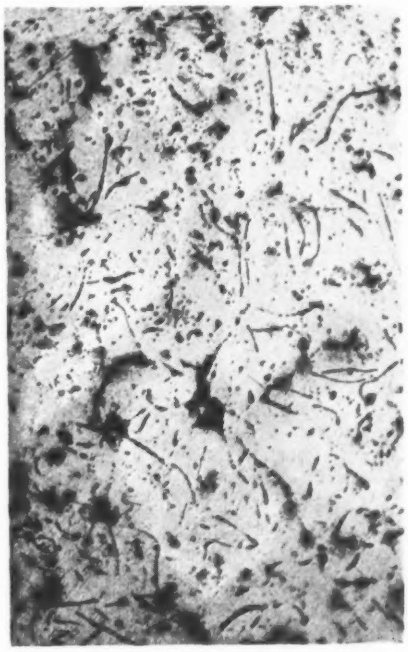


Fig. 3. Appearance of Specimen after Final Polishing with H46 Medium Compound

Cost-Saving Fixtures for

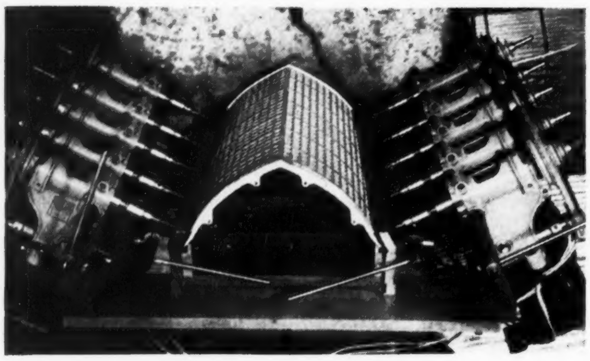


Fig. 1. *A Simple Fixture for Drilling Ten Holes Simultaneously in a Die-cast Radiator Grille*

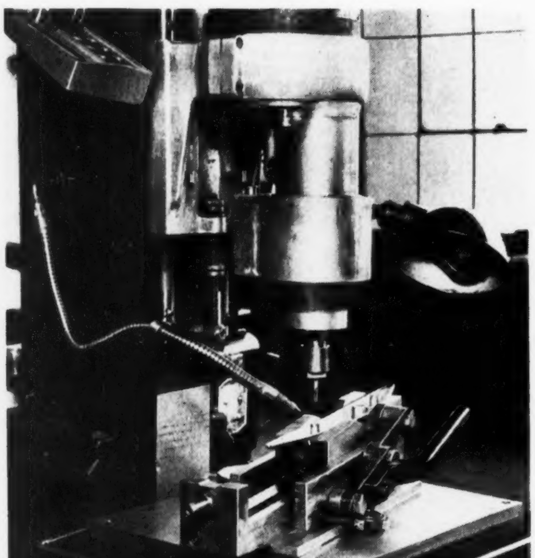
Examples of Tool Equipment that has been Advantageously Employed for Rapid Handling in Finish-Machining Operations on Die-Castings

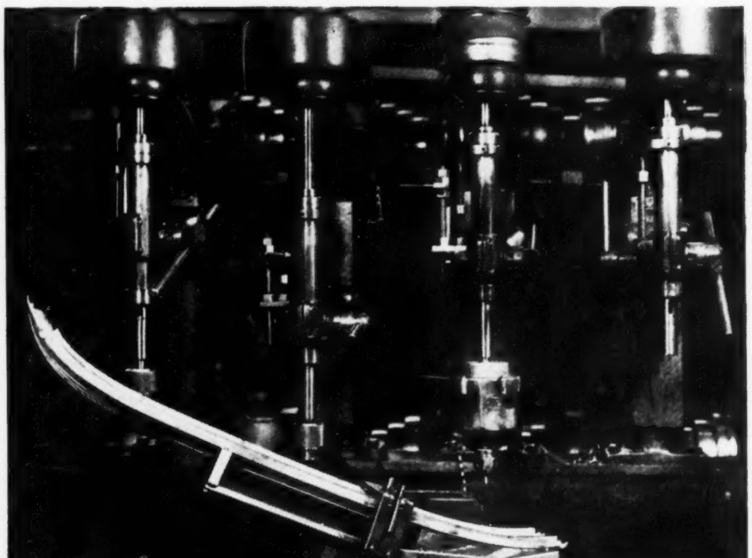
MANY holes can be accurately cored in die-castings, and occasionally threads can be cast in them to advantage. In other instances, however, it is cheaper to drill and tap holes, especially small ones and those that are so placed that extra slides in the die are needed if they are cored. In some instances, holes can be punched in die-castings, especially in the zinc-alloy type. Often holes that are cored require light reaming. In addition, bosses are frequently spot-faced, or other simple machining involving light cuts is needed. To facilitate handling and to obtain precision, special rapid-operating fixtures are often employed to advantage. A few of these fixtures are described here in the belief that they can be adapted to other work or will suggest convenient ways in which die-castings can be held for machining.

Fig. 1 shows a fixture for drilling ten holes simultaneously in a die-cast radiator grille. Clamps are operated by a rack and pinion arrangement at each side, after which the two groups of five spindles are

Fig. 2. *(Below Left) A Fixture Used in a Haskins Tapping Machine for Tapping Holes at Different Levels*

Fig. 3. *(Below Right) Drilling and Tapping Holes at Odd Angles by Means of a Rocking Fixture*





advanced by turning the long pinions which have been passed through the drill heads. The latter are standard and inexpensive units assembled in two banks, one at each side, and each driven by a common belt so that only two motors are required. This fixture is more elaborate than most, but, in effect, constitutes an inexpensive ten-spindle machine which does the work almost as quickly as the castings can be loaded into it.

Other Fixtures for Drilling and Tapping

The tapping of boss holes, often at different levels, is a frequent requirement in die-castings. This work is being done rapidly and at low cost in a Haskins tapper equipped with the fixture shown in Fig. 2. The fixture has a block recessed to fit the top surface of the casting, which is shown top down. One hole is tapped in the position shown, after which the supporting block, mounted on an inclined track, is shifted to the operator's left by swinging the handle. When at the left, the casting is at the correct height and in the proper transverse position to tap the second hole, as the block comes to rest against a stop.

Drilling and tapping of holes at odd angles can be done conveniently in the rocking fixture shown in Fig. 3, which is designed to handle a curved section of truck grille. When in the position shown, the operations are performed in bosses at the lower end of the die-casting, the base, supported on pins which slide on the table of the drill press, being shifted by hand, as required, to bring the work under the tools. A latch, supporting the cradle of the fixture in the position shown, is then shifted, permitting the cradle to rock until its left end is in contact with another stop. In this position, other bosses to be tapped and drilled are at the correct angle with reference to the drill and tap axes, and the fixture is again shifted by hand to bring the work under the respective tools. With a suitable arrangement of stops, a fixture of this kind can be shifted to three or more angular positions.

Shearing Flash from Die-Castings

The shearing of the flash from die-castings is commonly done by the die-caster, but in some instances, customers who have their own equipment specify that castings be shipped with the flash on them. The methods used in flash-shearing are, therefore, of interest to die-casting users, some of whom may well use a multiple die, such as shown in Fig. 4, which shears the flash from three padlock parts at the same time. To use a die of this kind, the set-up must be designed to fit the gate of the casting as it comes from the die, as the distance between the dies must match that in the gate. Such an arrangement is not always feasible because of variable shrinkage in the flash or runners that hold the castings together. It works well in this instance and saves considerable time over that required for shearing the flash from the three castings separately, after they have been broken from the gate.

For convenience in casting and to assure correct flow of metal into each rib of the grille shown in

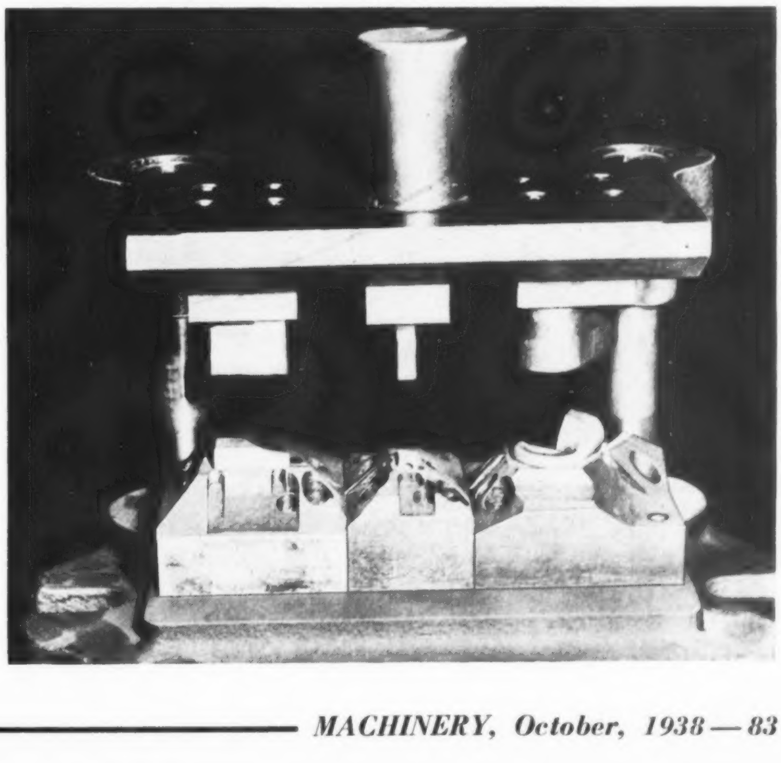


Fig. 4. A Multiple Die which Shears the Flash from Three Padlock Parts at the Same Time

Fig. 5, this piece is cast with metal partly filling the horizontal slots near the top. Hence, a punching operation is required to shear out the metal in these slots. For this operation, the grille is placed in the curved fixture shown, which is the lower half of a punching die. When in this position, the punch, which has stepped-tooth blades, is tripped, and the excess metal is sheared out. As zinc die-castings have high impact strength at room temperature, there is no danger of cracking the casting, so long as it is properly supported in the fixture.

Another Case of Multiple Drilling

Sixteen holes, in all, have to be drilled in the sides and end lugs of the die-cast grilles shown in Fig. 6. Eight of these holes are drilled simultaneously on a multiple-spindle drilling machine. The fixtures have quick-acting clamping means, which fasten the grilles in the required positions around the edge of the table. Three men handle the grilles to expedite loading, but the time required per hole is quite short, and shorter than it would be if three machines requiring three men were employed to do the same job.

In the operation shown in Fig. 7, a tapered seat is being machined by a fly cutter in a drill press. The die-casting has a coarse thread cast on its outer cylindrical surface, this thread being formed to mate with a similar thread cast in the recess of the part shown at the left. Because of the male thread on the part to be machined, it cannot be held with assurance of correct position and without marring the thread unless the clamp holding it mates with the thread.

The mating jaws in this instance are made in an inexpensive manner by cutting one of the mating castings into two, and fitting the two halves into the steel jaws of the holding chuck. The latter are operated by cams fitting into curved slots in a disk which is turned by the handle shown at the right, in which position the work is locked and held securely with its axis coinciding with that of the cutter. Moving the handle to the left unlocks and opens the jaws, releasing the piece.

Punching Holes in Die-Castings

It is often necessary to clear the flash from a hole cored in a die-casting, and, as this means a drilling or punching operation in any event, it is frequently less expensive to drill or punch the hole itself without coring it, as this may save cost in the die. This is exemplified in the set-up shown in Fig. 8, in which five holes about 1 1/4 inches in diameter are punched in the face of a lighting fixture, the casting, piloted on a pin which passes through the cored central hole, being indexed around. The pilot-pin

Fig. 5. A Fixture Used in Shearing out the Metal in the Slots of a Grille

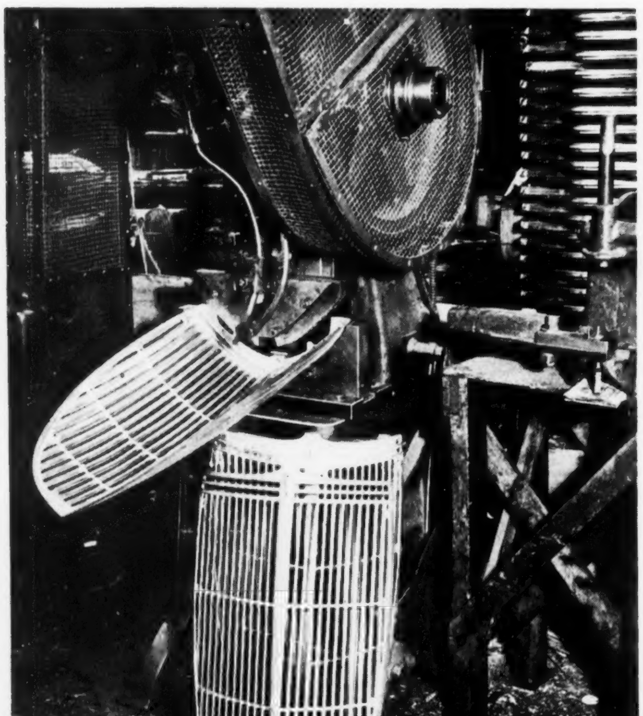
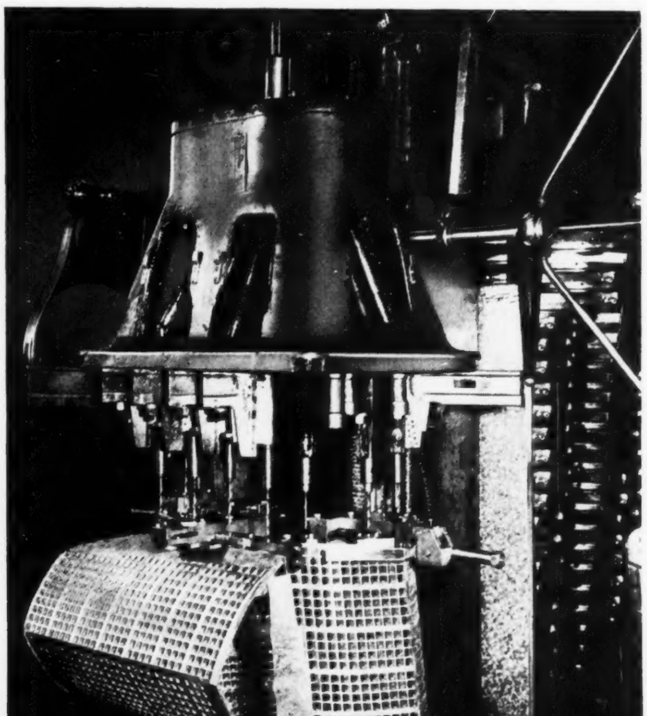


Fig. 6. Drilling Sixteen Holes in the Sides and End Lugs of Die-cast Grilles



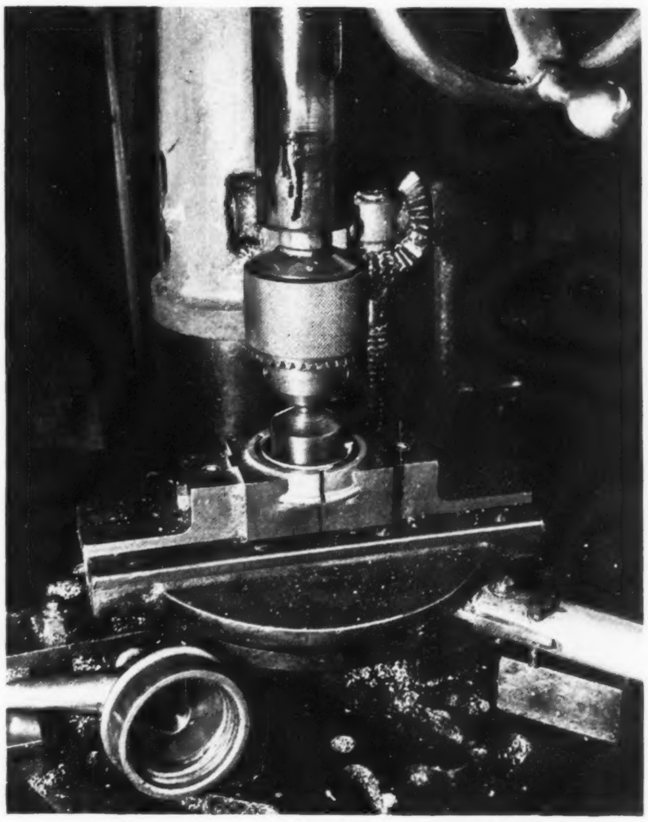


Fig. 7. Holding a Threaded Die-casting while Machining a Tapered Seat

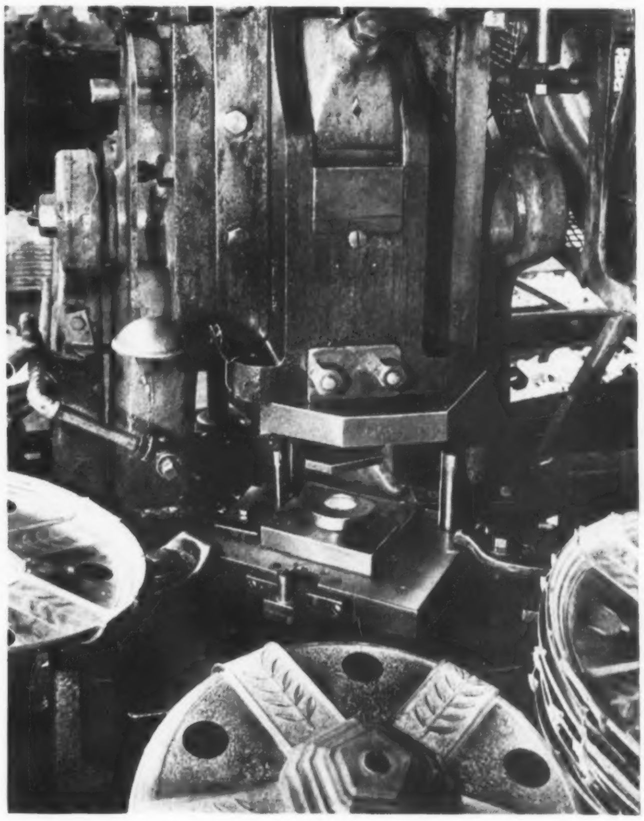


Fig. 8. A Case where it is Cheaper to Punch Holes in a Die-cast Part than to Core Them

is seen at the near edge of the punching die, which is very simple and inexpensive.

There is added economy in this instance, as the same fixture is used for a similar die-casting in which three equally spaced holes are required instead of five. It would be possible, of course, to punch all the holes required in a casting of this type at one time if a die for this purpose were made, but the cost of so large a die would be much greater than for that shown.

How Hard Should a Tap Be?

By H. GOLDBERG, Vice-President
R. G. Haskins Co., Chicago, Ill.

TESTS made during many years of tapping with high-speed steel ground-thread taps show that the ideal hardness of a tap should be about 63 Rockwell C. It should never be below 61 or above 65. If the hardness is below 61 Rockwell C, the corners of the teeth wear very rapidly; if the tap is harder than 65 Rockwell C, the teeth show a tendency to chip slightly at the chamfer, especially when tapping hard or tough materials.

Recently a heat-treating process was developed for surface-hardening taps after they have been ground in the thread. The process has an effect similar to that of nitriding, and gives a glass-hard surface on the outside of the tap for a depth of about 0.0002 inch. This method of heat-treating taps is useful because it eliminates the possibility of having the angle of the thread soft. It is really a simplified nitriding process, done after the tap has been regularly heat-treated and the threads have been ground.

Tests show that this additional heat-treatment does not change the original heat-treatment of the tap, nor does it affect the accuracy of the lead, angle, or pitch diameter. Taps so heat-treated have proved to be especially useful in tapping soft stringy steel, as tap loading and pick-up of metal are eliminated. They are also useful for tapping highly abrasive materials, such as cast iron and synthetic plastics (Bakelite, Durez, Micarta, Plaskon, etc.).

New Tool-Holders Make Carbide

Fig. 1. An Adjustable-angle Cutter-holder—One of the New Tools that Make Carbides Available to the Small Shop

The Use of Carbide Tools in Turret Lathe Practice Necessitated the Redesign of the Entire Line of Standard Turret Tools Formerly Available

By JAMES R. LONGSTREET
Development Engineer
The Warner & Swasey Co.
Cleveland, Ohio

DESPITE the tremendous advantages of carbide cutters, their use on turret lathes heretofore has generally been confined to the high-production field. This has been due partly to the fact that manufacturers of carbides, when the new cutters were introduced, naturally concentrated their attention on the high-production shops rather than on the average-lot shops, because of the larger market in the former field.

But even with the use of carbide cutters now well established in the high-production field—and even with the added experience that came as the result—carbide cutters have not been widely adopted in the average-lot shop. The fact is that the small producer has been limited in the use of carbides by the limitations of the standard tools available for holding the new cutters and applying them to the work. The large producer, on the other hand, has not been limited in the same way, because he has resorted to special tools for making combined and multiple cuts, an expedient which the small producer could not afford.

The peculiarities of carbide cutters which limited their use with standard tool-holders are well known. Although carbides are one of the hardest and strongest groups of metals, they have no elasticity. They tend to be brittle, and consequently cannot be subjected to much vibration or chatter. With the introduction of carbide cutters, machine tool manufacturers were not long in recognizing the need for stronger, generally redesigned machines to meet the new requirements of increased speeds and extreme rigidity; but except in the case of a few simple holders, standard tool-holders were not redesigned to adapt them to the fast-cutting carbides.

Several years ago the Warner & Swasey Co., more or less experimentally, built a roller back-rest turner for carbide practice. That tool was so successful, and improvements in its design resulted in such increased tool performance for all types of cutters, that it was decided to study the whole field of standard tooling. After almost two years of extensive research, a complete new line of standard tools was recently announced to the trade. These tools make carbides available to the small shop in all lines of work—in bar as well as chucking work.

In studying the many factors involved in the design of a new line of standard tools for average-lot production, it was obvious that one factor would have to be given greater consideration than formerly—that was the matter of quick set-up.

The small-lot producer, even more than the large one, must obtain the maximum results from his available cutting time. Therefore, his efforts are directed toward cutting down the elements of both set-up time and handling time of machine and work. With the greatly increased cutting speeds that came with the use of carbides, set-up time became a matter of major importance. Decreasing the set-up time of a line of tools meant, of course, designing tools that would be easily and quickly adjustable. In building adjustability into tools, however, there is apt to be a tendency toward building weaknesses into their construction. Any sliding joint, if not properly designed, can be a serious point of weakness.

To produce a line of standard tools that would

Cutters Available to Small Shops

combine in their construction both extreme rigidity and maximum adjustability, it was necessary to evolve a new technique in design. Typical of this new technique is the adjustable-angle cutter-holder shown in Fig. 1.

This tool was used for the most part in making finishing cuts or roughing cuts of small depth. In earlier designs, the adjusting head was of open slotted construction and the rigidity of the tool depended upon the strength of the bolted split dovetail joint. The new design does away with the split dovetail and clamp screw construction, using instead a closed type slot and a taper wedge binder which gives a C-clamp effect. For equal shank sizes, this increases the strength of the tool at least three times, making the present design available for heavy roughing cuts. The reversible adjustable feature allows cutter overhang to be kept at a minimum, thus eliminating the necessity of over-extending the cutter from the holder in order to reach in-between diameters.

Fig. 2. A Single Adjustable Turning Head which Opens up New Possibilities in Heavy-duty Turret Lathe Practice

Similarly, it was found in surveying the general tooling conditions in the average shop, that only one turning cutter was set in any one hexagon turret station in combination with a drilling or boring cut. Especially on short runs, with carbide cutters, it was simpler and easier to set up the operation this way. The solution to this problem was found in the single adjustable turning head shown in Fig. 2. This tool provides a flexibility in tooling that revolutionizes heavy-duty turret lathe practice. The turning cutter holder, held in an adjustable block, is quickly set to size and can be changed from one job to another by simply moving the block up or down. Combined turning and boring cuts can be taken using a boring-bar in the center hole at the same time that the turning cut is being taken. The tool is especially suited to carbide practice by the fact that the large heavy-duty turning cutters, due to the adjustable block mounting, can be set with the minimum overhang necessitated by chip clearance.

A pointer and scale is provided for rough setting and a large micrometer dial for very accurate setting. Owing to the unusual construction of this tool and a combination of taper wedge clamps, the tool body and the adjustable block act as an integral unit. This, and provision for piloting, give the tool great rigidity.

A quick-acting slide tool, which combines in one attachment the best features of the standard slide tool and the standard boring and recessing tool, is another completely new device. The standard slide tool, a very popular attachment, has always been easy to adjust, but with the introduction of carbides into the small-production field, it was necessary to increase its strength. This was accomplished by changing its design from a full dovetail to a dovetail and square lock construction. The addition of adjustable stops to control the travel of the slide provided a further refinement. In the larger sizes of slide tool, the stops are of a receding type, so that when necessary, the operator can easily "override" them.

In the line of bar tools a series of multiple-cutter turners with roller back-rests in a complete range of sizes was developed for use with carbide cutters in all bar capacities of from 1/4 inch to 7 inches (Fig. 3). This tool is tied up rigidly in a roller-arm construction through its base, roll bracket, and cutter block. It is also tied together lengthwise through the addition of an overhead strut—thus all cutting strains are self-contained within the tool. The rolls are of the heavy-duty anti-friction type, with large center studs for heavy loads. The roll bearings also allow for free turning on light cuts.

Some of the other new tools available as standard equipment are an adjustable knee tool (Fig. 4) for short bar work, a taper turner with roller back-rest, stub boring-bar sleeves for eliminating excessive overhang on small diameter stub boring-bars, and stub boring-bar cutter-heads for combining chamfering and boring cuts in one operation.

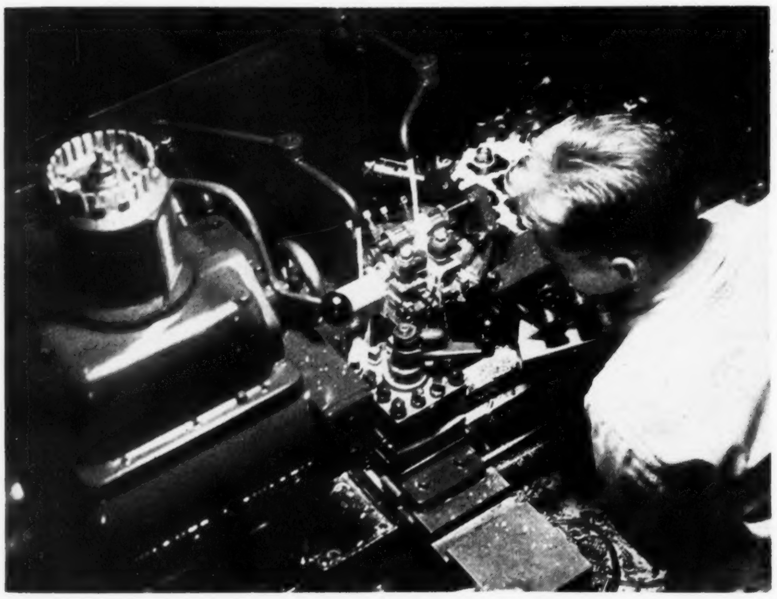


Fig. 3. Multiple-cutter Turner with Roller Back-rests Designed so that all Cutting Strains are Taken up within the Tool

These examples are but a few of the more important basic tools that are making it possible for the average-lot producer to use carbide cutters with standard tool-holders. The demand for increased rigidity required with carbide cutters, however, was met not only by the redesign of the setting tools, but also by the development of a stationary type overhead piloting.

Heretofore the overhead pilot bar was always fixed to the multiple turning head; its free end fitted into a bushing on the headstock of the machine. The new stationary type overhead pilot bar is fixed at the other end—on the headstock of the machine—and fits into a bushing on the multiple turning head. It can be quickly adjusted endwise to obtain the proper extension for each job. The stationary type overhead pilot bars are of large diameter, making them at least twice as strong as the old type pilot bars; thus maximum support for heavy-duty multiple turning heads and adjustable single turning heads is provided.

With the pilot bar fixed to the head of the machine, only one bar is now needed to serve any number of multiple turning heads. Heretofore, with the bar fixed to the multiple turning head, as many bars were needed for each set up as multiple turning heads used. Moreover, the new arrangement eliminates the unwieldy swing of pilot bars around the machine, reduces the weight on the hexagon turret, and decreases the time required to index the turret by shortening the stroke.

All these new tools, while designed particularly for carbide production, also, of course, increase the productivity and efficiency of Stellite and high-speed steel cutters. For regardless of what kind of cutter is used, the weakest link is a weak holder. With the new tools, the average-lot producer has been placed in a much more favorable competitive position with the high-production shop. Eliminating the need for costly special tools, standard equipment to cover the whole range of turret lathe work is now available to both.

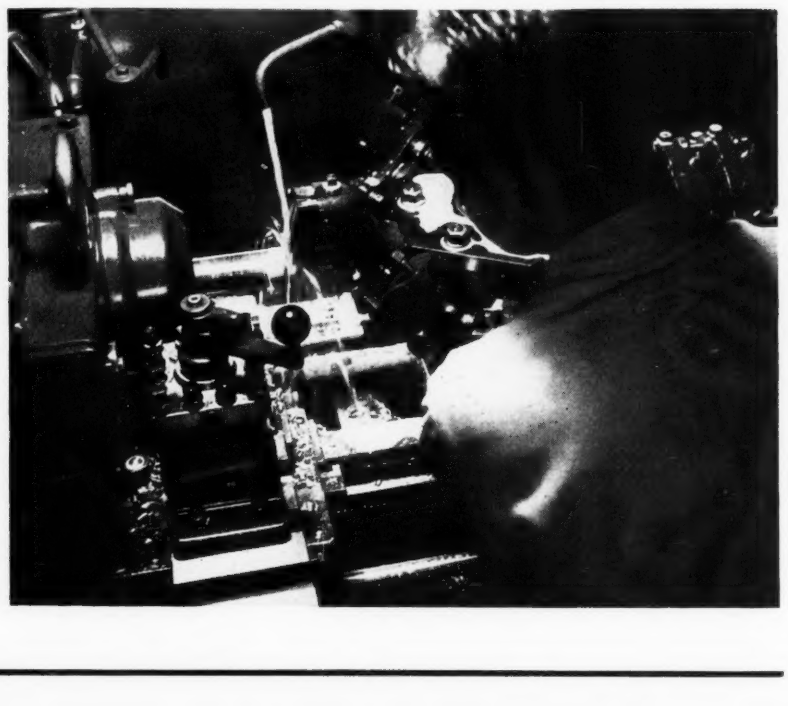


Fig. 4. An Adjustable Knee Tool for Short Bar Work—Another Tool that is Specially Suited to Small-lot Production

Milling off Gates on Malleable Castings

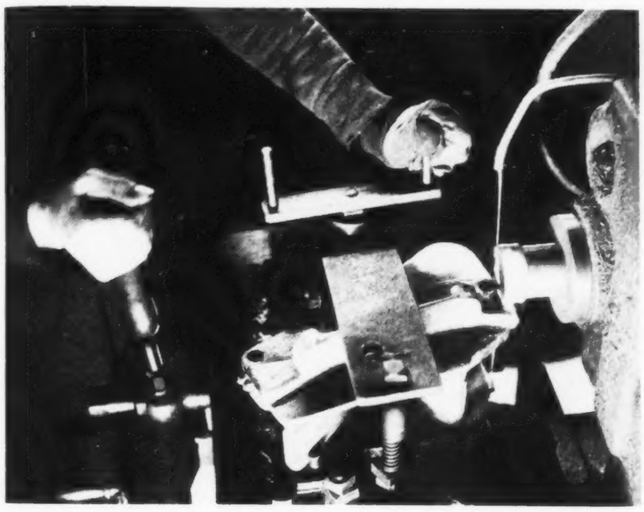


Fig. 1. Removing a Gate from a Malleable Casting by Milling. No Teeth are Seen on Cutter Because Photograph was Taken while Operating at High Speed

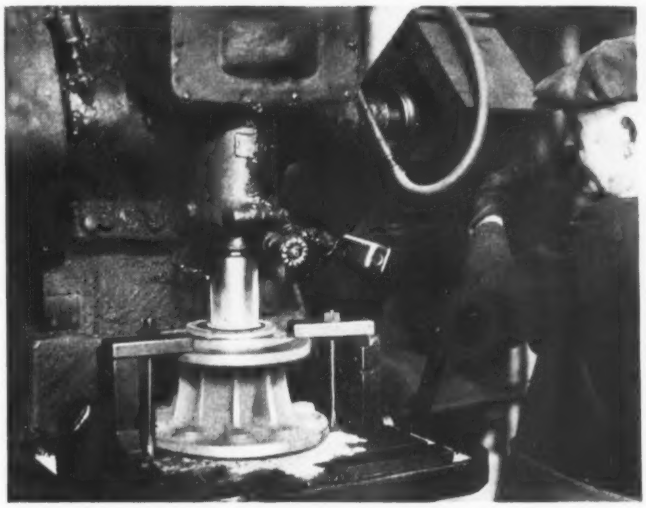


Fig. 2. Using a Vertical Milling Machine Equipped with a Milling Cutter for Removing Gates on the Inside of a Large Truck Hub Casting

An application of milling cutters that is not in general use has been developed recently within the malleable iron industry. Here hand-fed milling machines and heavy-duty drilling machines equipped with milling cutters are used for the removal of gates on castings. This method makes it possible to remove the gates rapidly, irrespective of their position on the casting or the shape of the casting. The malleable foundry industry claims that this method of easy removal allows the gates to be placed at any point required in order to produce a casting insured against shrinkage.

Horizontal hand-fed milling machines are used whenever possible; but in the case of cored castings containing gates inside the cored portions, such as large truck hubs, vertical drilling machines with cutters mounted in them are used. These drilling machines may be equipped with tables that can be moved vertically by means of a foot-treadle, or may have a hand-operated vertical table movement.

One large producer of automotive malleable castings estimates that this method of gate removal has speeded up the process from 25 to 40 per cent, besides being much more accurate.

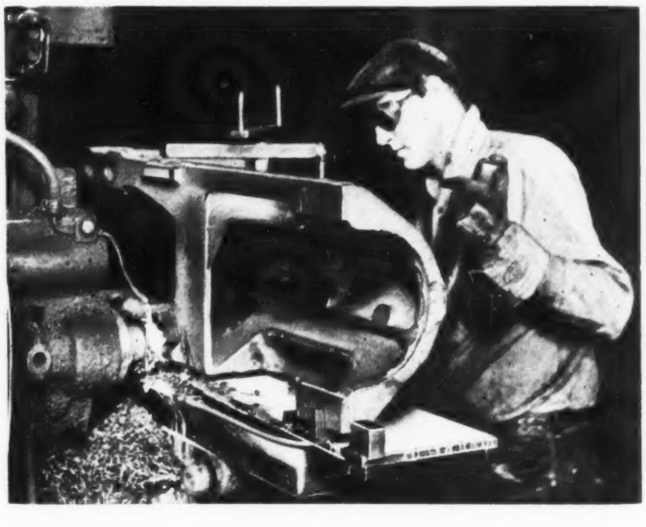


Fig. 3. A Heavy Malleable Casting with Large Gates that are Removed by Milling

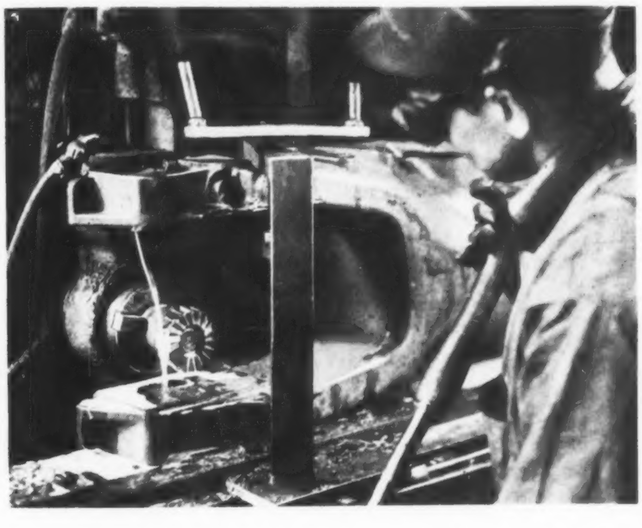
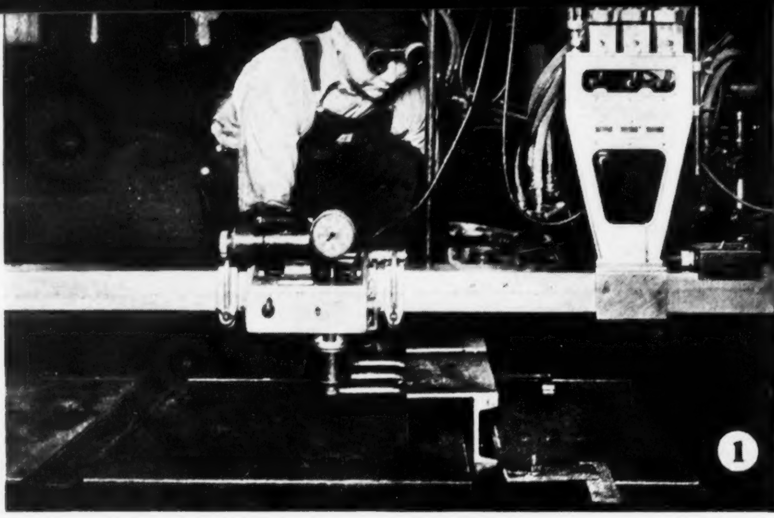
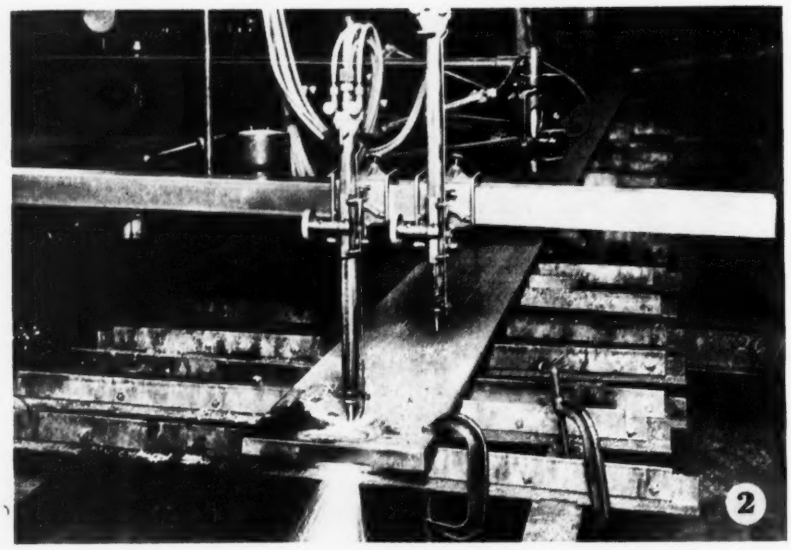
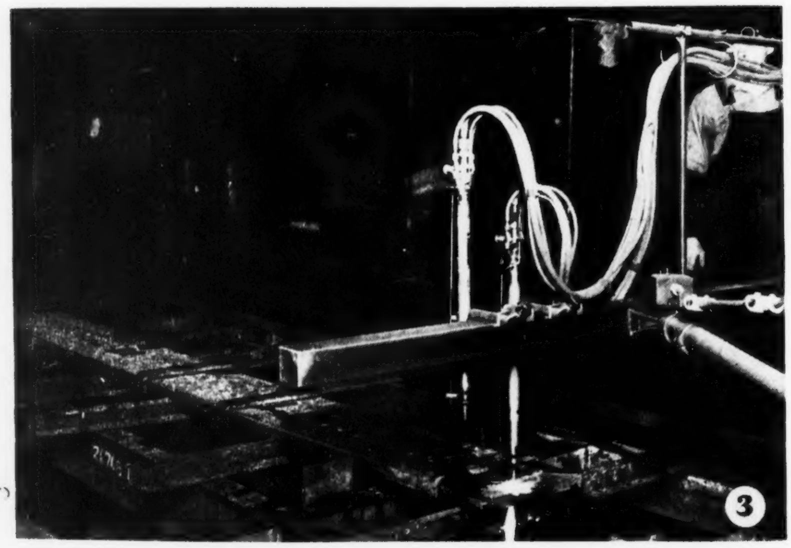
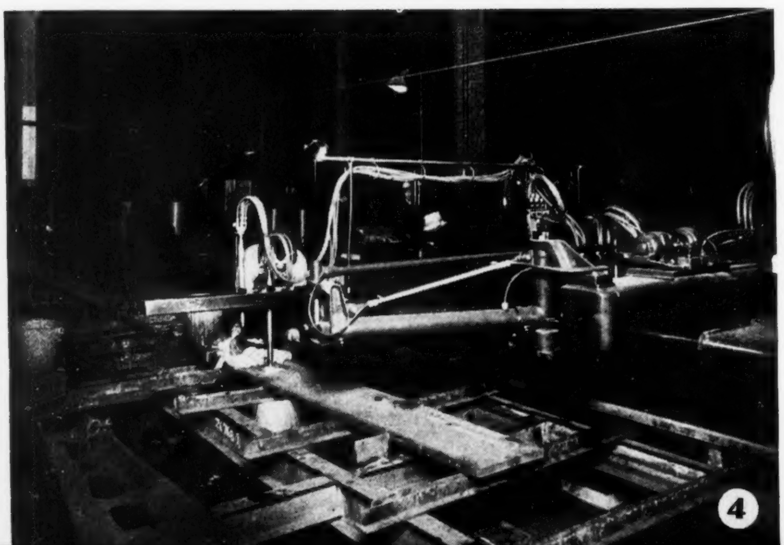


Fig. 4. Another Casting on which the Gates are Removed by Milling









Flame-Cutting Expansion

The illustrations on this and the opposite page show how a 44-foot expansion joint for the Blue Island Bridge over the Calumet Sag Channel was flame-cut from one piece by the Travograph, made by the Air Reduction Sales Co., New York.

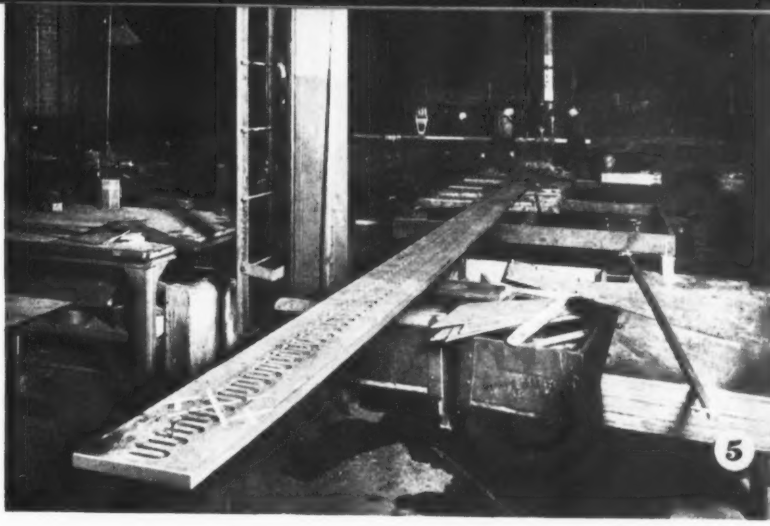
This flame-cutting was done by the Heil Co., Milwaukee, Wis., for the Wisconsin Bridge & Iron Co., with the assistance of the Applied Engineering Department of the Air Reduction Sales Co. As the illustrations show, the work was completed with one continuous zigzag cut.

The illustrations show the progress, step by step. Fig. 1 shows the sectional templet and magnetic tracer being arranged preparatory to cutting. The sectional templet was then firmly attached to the guide bolted to the tracing table.

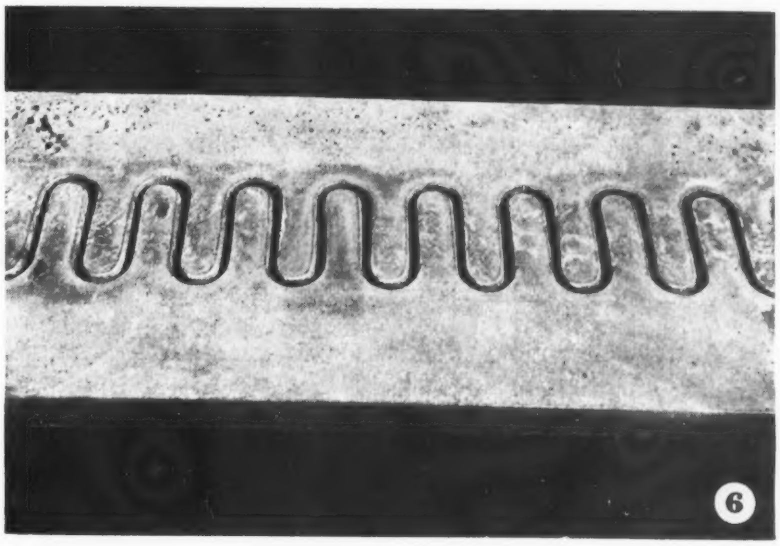
Fig. 2 shows how the cut was started at one end from a hole, 5/16 inch in diameter, drilled in the plate about 1 1/4 inches from the end of the slab. Fig. 3 indicates how clamps were arranged and adjusted across the steel slab during cutting.

a 44-Foot Bridge Joint

Photos, Courtesy Air Reduction Sales Co.



In order to eliminate warpage, water-soaked waste was placed just back of the torch. Fig. 4 shows the progress of the operation, and indicates how this method of cooling was applied behind the cutting torch as it progressed through the cut.



In Fig. 5 is shown a view of the completed expansion joint. This illustration also shows the work-table, the track for the Travograph, and the tracing table. Fig. 6 shows a close-up view of the two sections of the joint just after the cut had been completed.

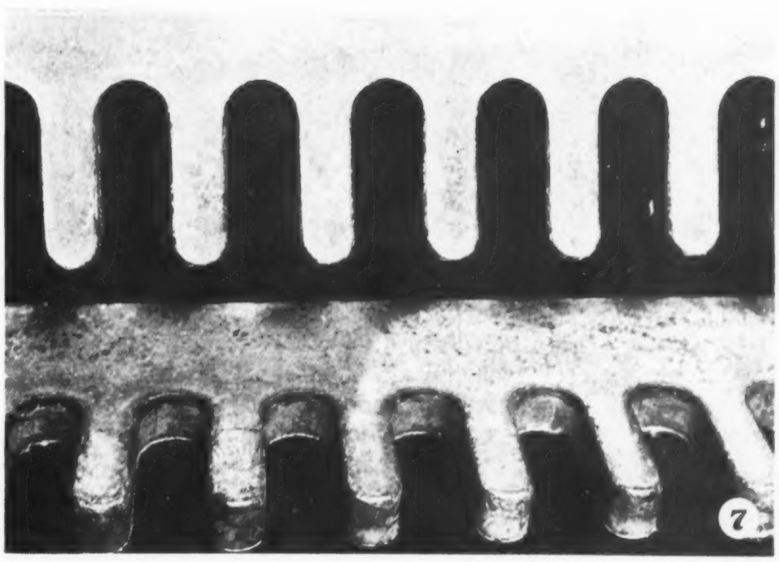
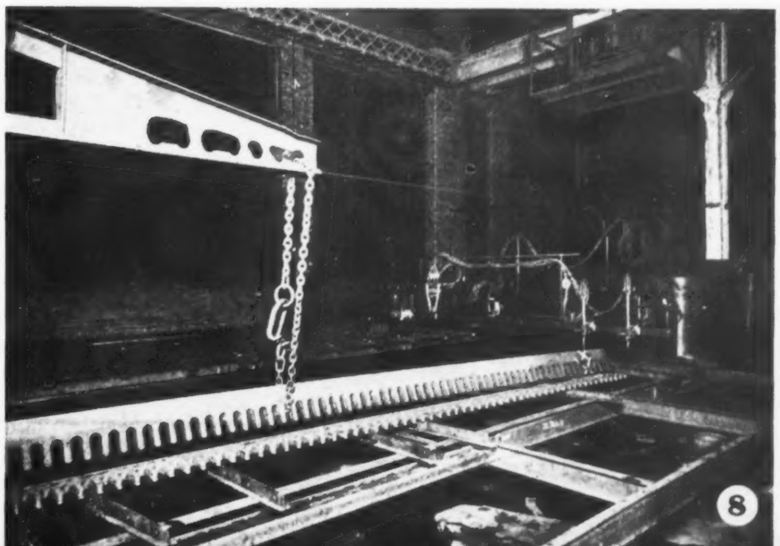


Fig. 7 shows another close-up view of a section of the expansion joint, indicating the appearance of the finished cut. Finally, Fig. 8 gives a clear view of the finished work, which is shown being removed from the tracing table.



The actual length of the zigzag cutting done in producing this expansion joint was 156 feet 3 inches. The material that is being cut is a copper alloy steel slab having a total width of 15 inches before cutting, and a thickness of 1 1/2 inches.

Why Do Cutting Tools Become Dull?

This Article Discusses Briefly the Factors that Determine the Life of Cutting Tools, with Special Reference to the Newer Cemented-Carbide Group

By GEORGE M. MENCKE
Sales Manager, Vascoloy-Ramet Corpn.
North Chicago, Ill.

THE problem of answering the question "Why do cutting tools become dull?" was assigned to the writer more than twenty-five years ago by the late William Lodge, who, at that time, predicted that high-speed steel, which was just coming into general use, was not the last word in cutting tools, but that there would be other startling developments.

In the twenty-five years since Mr. Lodge made this prediction, three major innovations in cutting tool materials have had a profound influence on machine shop practice, and much study has been given to the action of cutting tools; yet the available data is still too meagre to permit of a complete scientific answer to the question "Why do cutting tools become dull?"

At the time when the writer first began to look into this subject, it was not a question of the number of parts per grind, so much as a question of the number of grinds per part. Frequent grinding was such a normal part of shop routine that it made a study of the tools very difficult. In the early days of high-speed steel, the efforts to prolong the cutting life of tools were confined to forging and tempering to obtain the most effective combination of strength and hardness. Grinding was left to the operator and his supervisor, and little or no effort was made to determine the effect of grinding and tool shapes on the length of life of the tools.

Where do Tools Begin to Wear?

Finally there came a realization that tools became dull because of abrasive wear at two points—at the front or clearance, due to the abrasive friction of the edge in contact with the work; and at the top or rake, due to the pressure resulting from the resistance of the metal to the blunt cutting wedge necessary in metal cutting. The problem of getting the most per grind out of a tool has to do with combatting the wear at these two points. From observation of a dull tool, the tool engineer pictures mentally the development of this wear, and pursues his line of logic as to what to do in regard to speed, feed, cutting angles, mounting of tools, tool material, etc.

On cast iron, very slight rake has always been considered good practice, because this metal crushes and crumbles off; the gritty particles are so abrasive that a blunt wedge presents more area to resist this abrasion.

Steel cutting differs in that the steel tends to split above the cutting edge and the continuous chip formed tends to dig its way into the rake or top of the tool. To reduce this digging or cratering, rake angles were increased to about 15 degrees; they were limited to this point because further increase weakened the cutting wedge. On high-speed steel tools, the rake wear on the top of the tool is always secondary to the wear at the front or clearance angle of the tool. Clearance angles up to 15 degrees are usual practice. It is permissible to vary the clearance angle to compensate for wear and thus prolong the life between grinds.

Another factor that has prolonged the life between grinds has been the increase in hardness and wear resistance of the tool material. Thus loss of hardness is no longer a factor with some tool materials, and, with others, the necessity for strength in the tool has led to wide departure from high-speed steel practice.

Two Theories Concerning the Wear of Cutting Tools

Two theories have been advanced in explanation of metal-cutting action. About 1920, the adherence of a compressed chip that built up on the edge of a steel cutting tool led to the explanation that this built-up edge actually served to cleave the metal and tear it from the stock. Another explanation was that the steel splits due to the pressure exerted on it, and that the built-up edge is due to the final scraping to size of the torn metal by the point of the tool underneath the chip, where the coolant is ineffective and adherence of the hot metal of the chip is a natural result. The advent of tool materials cutting at speeds beyond those of high-speed steel served to strengthen this explanation, because, as speed increases, the built-up edge decreases until it disappears entirely. This decrease in the size of the built-up edge is due to the fact that as the speed increases, the point of wear on the rake moves forward to the point of the tool until it meets the point of wear on the clearance. The speed at which this occurs has come to be known as the "critical speed," or the speed at which the work is actually being cut rather than split; hence the work is smooth and the torn marks disappear.

The second theory is the grinding wheel analogy. It is based on the belief that the cutting tool dulls or breaks down in a manner similar to that of a grinding wheel. It is said that maximum tool life is obtained when there is equal wear at the rake and at the clearance, and that as molecules of metal wear away equally in both these directions, the cutting wedge renews itself, just as the falling off of damaged grit from a grinding wheel brings new fresh grit into use. It will be noted that when the critical speed is reached and the rake contact meets the clearance contact, the conditions on which both theories are based are identical.

The Dulling of Tools in Relation to the Tool Material

The dulling of tools is influenced by the elements entering into the tool material. The carbon that causes hardness of carbon steel remains the chief hardening element in all cutting materials. High-speed steel is substantially carbon steel with an additional alloy metal, generally tungsten. The alloy ingredient gives the steel higher heat resistance. The first entirely American development in cutting tools was the innovation of Stellite. Whereas iron was the bonding material in prior cutting tools, cobalt was introduced as the bonding medium in Stellite. In this material, the temper was not drawn by rising temperature, and new speed possibilities were present because the drawing of the temper in carbon steel is the most rigid of the limitations of tools made from it. Cobalt-bonded tools have inherent hardness, and hence no temper to lose, which accounts for the higher speeds possible.

The three elements of carbon, tungsten, and cobalt present in Stellite are also present in the third innovation in cutting tools—tungsten carbide. Sintered carbides have made possible a tool metal containing larger percentages of carbon and tungsten than were formerly possible, increasing the hardness and resistance to wear so that speeds three or four times those previously possible could be used. The normal field for the application of tungsten carbides is in the machining of materials that crumble and that are cut by abrasion rather than by shearing—including cast iron, brass, and materials that were very difficult to machine with earlier cutting tools.

The great increase in cutting speed of these new tools led to more severe conditions of application and the development of a technique not formerly considered necessary. Cutting tool applications ceased to be the job of the mechanic at the lathe or milling machine and became a specialized mechanical occupation.

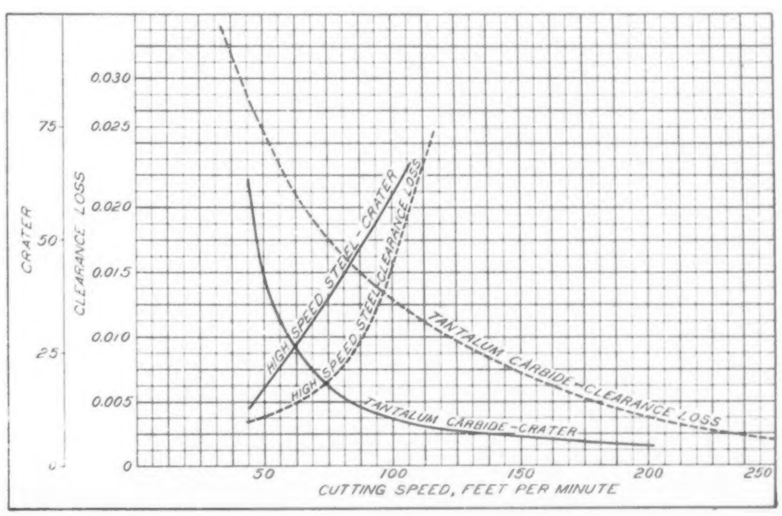
In 1932, the Fansteel Metallurgical Corporation introduced tantalum as an additional element in cutting tools, bringing steel within the scope of materials that could be cut with sintered carbides. This addition of tantalum to the cobalt-carbon-tungsten combination was the second American innovation in cutting tools. It was made for the purpose of retarding the abrasive action of the chips that had been digging the crater into the rake of cutting tools and thereby limiting their life. Instead of using a steep rake angle to minimize the formation of a crater, as practiced with high-speed steel, the crater-resisting quality of tantalum carbide makes practical the small rake angle that sintered carbides require for mechanical strength. For cutting iron, semi-steel and other abrasive materials, this crater-resisting quality serves to equalize the wear between the clearance and the rake, and so satisfies the theories that have been offered in explanation of tool wear. In addition to the elements mentioned, titanium, columbium, and nickel are now used in some types of sintered carbides.

The attention to details in tool application that became necessary in the use of the new cutting metals has been extended to the use of high-speed steels, with a corresponding improvement in the results obtained. New ingredients have also been added to high-speed steel to broaden its scope and improve its service.

The Importance of Running Carbide Tools at High Speeds

It is not news to users of carbide tools that they can be run at higher speeds than steel tools, but it *is* news to many that it is essential to run them at

Chart Showing How the Wear on High-speed Steel Increases with the Cutting Speed, while it Decreases with the Speed on Carbide Tools. The Graduations on the Crater Forming Scale to the Left are Arbitrarily Selected for Comparison Only



higher speeds. Because loss of temper limits the speed of steel tools, it was first supposed that the temperless tool materials would be applicable at the same speeds as steel tools, but for a correspondingly longer run between grinds. Actually, the exact opposite is the case, as illustrated by the accompanying curves, in which the clearance loss and the extent of crater wear of an 18-4-2 high-speed steel tool and a grade of tantalum-carbide tool are plotted for a range of cutting speeds, but with a constant feed and depth of cut. Identical material is, of course, being cut.

Note that when the carbide tool is run at 50 feet surface speed, it is much inferior to the high-speed steel both as regards the wear on the clearance angle and on the rake. At 60 feet, the crater or rake wear is equal, and at about 97 feet, the clearance losses are equal. At about 110 feet, high-speed steel reaches its speed limitation; but the tantalum carbide reaches its critical speed at about 200 feet. To exactly satisfy the equal wear theory, the tool engineer would reduce the clearance angle slightly at this speed and thus reduce the clearance loss somewhat. For all practical purposes, however, no change in angles would be made, as variations in the material being cut would be likely to absorb what differences may appear on the chart.

This curve confirms the practical experience of many production men. It indicates that if you do not have the available speeds on your machine, a high-speed tool will have a longer life than a carbide tool. Unless you can use high speeds, there is no reason for the application of a carbide tool.

Don't Stop the Spindle with the Feed Engaged

There is one important point in the application of cutting tools that should be emphasized. This point applies to the machine tool rather than to the tool itself. The stopping of the spindle with the feed engaged dulls the tools or breaks them. High-speed steel tools get dull faster; on carbide tools, the tips break. Why is this?

If we turn back a quarter of a century or more, we find that machinists were always careful to preserve the cutting edge of their tools by throwing out the feed before the speed. It was the mark of a good mechanic to do so, and in some shops, failure to take this precaution was regarded as cause for transferring the man from a lathe to a drilling machine. As machine tools became more rigid and high-speed steels tougher, it was possible to indulge in this carelessness without too serious results; but frequently this carelessness has been the ruin of many carbide tools.

It is safe to say that no machine tool will ever be produced that has no backlash, no upward distortion of the spindle, and no downward deflection of the tool-holder that will be released when the speed is thrown out. Second, it is also safe to predict that no carbide will ever be developed in the use of which the throwing out of the speed under cut will be a safe procedure. Just as interlocking prevents the throwing in of the lathe feed-rod and lead-screw simultaneously, so an interlocking mechanism that makes it necessary to disengage the feed before the speed is thrown out will save many a carbide tool. It is possible to so combine the speed and feed control that the outward travel of the speed lever will throw out the feed first and permit a revolution or two before the spindle stops.

Electric drives offer opportunities for additional protection from abnormal tool loads. They make possible a power release to cut out the feed if the power input exceeds a safe overload. A no-load release that would disengage the feed in the event of power failure could also be provided. It seems advisable, in view of the ever widening field of inherent hardness cutting metals, to make machine tool feed-controls error-proof. It is the failures of tools that are needlessly broken or permanently dulled through carelessness that are most difficult to explain.

* * *

Carboloy Conducts Cemented-Carbide "School"

The Carboloy courses conducted under the auspices of the Carboloy Co., Inc., 2987 E. Jefferson Ave., Detroit, Mich., will be continued this fall, following the summer recess. More than 5000 management executives, production executives, and operators in the metal-working field have attended these free instruction courses since their inception in 1937. The courses are planned to thoroughly acquaint shop men with all the practical phases in the use of cemented carbide. They consist of a four- to six-hour session, during which more than seventy important points of practical value are reviewed. The courses are conducted either in the local Carboloy offices throughout the country or in the plants of users of cemented carbide. They are available without charge to all executives and shop men engaged in the metal-working industries. Arrangements to attend these courses can be made by addressing the Carboloy Co., Inc., at the address given above.

* * *

Industrial Machinery Exports

The United States exports of industrial machinery in July were valued at close to $21,000,000, according to the Machinery Division of the Department of Commerce, Washington, D. C. For the total industrial machinery group, this represents a 7 per cent decline from July, 1937. The exports of power-driven metal-working machinery, however, are higher than a year ago. These exports for July, this year, were valued at $6,488,000, or 39 per cent over July, 1937. Increased shipments were recorded for most of the types of machine tools and metal-working machinery.

Special Planer Tools for Increasing Cutting Efficiency

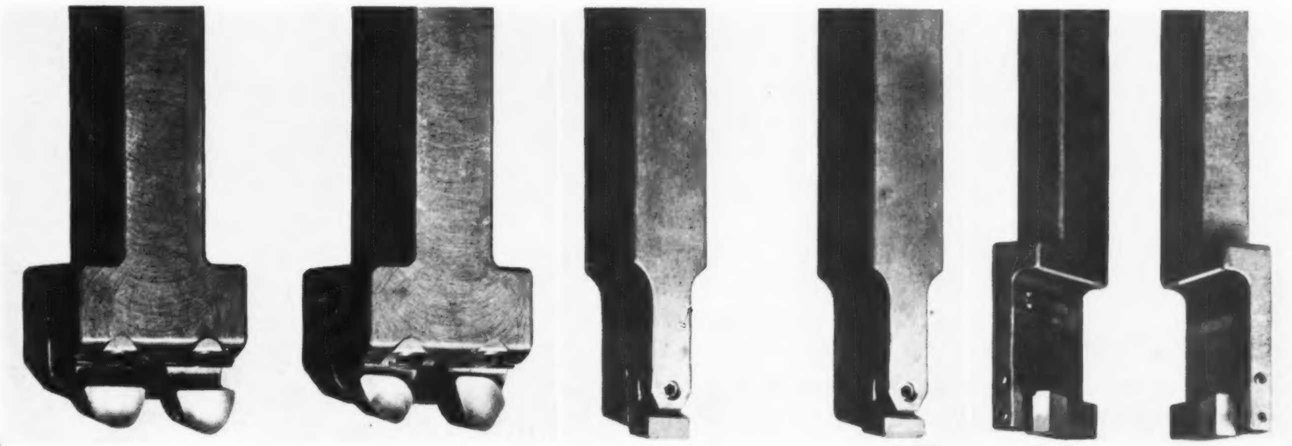


Fig. 1. (Left) A Double-surface Planing Tool by which the Depth of the Cut can be Divided between the Tools. Fig. 2. (Center) Tools for Straight Slotting that have Made it Possible to Increase the Feed by About 20 Per Cent, in Addition to Increasing the Cutting Speed. Fig. 3. (Right) Tools for Cutting T-Slots, the Use of which has Reduced the Time Required for This Operation by 40 Per Cent

THE accompanying illustrations show some special planer tools that have been developed by The Cincinnati Planer Co., Cincinnati, Ohio.

Fig. 1 shows a double-surface planing tool in which one tool is set a short distance back of the other. The distance between the two tools can be varied slightly by means of the slots or grooves indicated in the holder back of the tools. Assume, for example, that there is a depth of 3/8 inch of metal to be removed; then the first tool would take a 3/16-inch cut and the second tool approximately the same amount. It has been found that by dividing the cut in this manner, there is less heating of the tool, and, for that reason, the feed can be increased about 50 per cent, in addition to an increase in the cutting speed. There is also the further advantage that, at the end of the cut, there is less breakage at the point where the tool leaves the work.

Fig. 2 shows special tools for straight slotting. By using tools of this type, it is easier to maintain the correct clearance, particularly the correct top angle. This makes for easier cutting and keeps the tools free from interference. With this type of tools, it has been found possible to add 20 per cent to the feed and also to increase the speed.

Fig. 3 shows a radical departure from the conventional way of "elling out" T-slots, such as those in a planer table. Because of the shank for holding the tool, there is no interference when grinding the shape of the tool; also, the support of the cutting tool is always the same and can be made much more rigid than if a solid tool were used. Through the use of these tools, the time for cutting T-slots has been reduced about 40 per cent, due to the fact that a greater feed and slightly increased speed can be used, and that there are no delays from tool trouble.

* * *

A Nickel-Chromium Alloy "Reference Library" Consisting of Samples

At the Driver-Harris Co.'s plant in Harrison, N. J., Dr. J. M. Lohr, manager of the research laboratory, has accumulated, during the last fifteen years, a unique collection of thousands of alloy samples representing various combinations and proportions of ingredients, all duly tested and catalogued. This collection of samples virtually provides a "reference library" on nickel-chromium alloys for heat- and corrosion-resisting applications. In this collection there is an invaluable fund of practical information. Any specific requirement sought in a product can be checked against the tabulated records of the thousands of alloy samples. The actual samples can also be taken from the collection and subjected to special tests, if required. In this way, the experience of the past is recorded in a constantly available form.

EDITORIAL COMMENT

Research as an Activity of Big Business

A great deal is said these days about the importance of research in every branch of the engineering field. Obviously, a large concern is in a better position to do extensive research work than a small business. Research is expensive, and it requires the resources of a fairly large organization. The cost involved in equipping a laboratory or department for research is considerable, and it is expensive to maintain an adequate research engineering staff.

Almost every large enterprise in the engineering field throughout the country is doing its share of research work. The pioneer work done by big industrial corporations accounts for much of the progress of our industrial era, and is the basis of many of the comforts and conveniences that enter into the daily life of everybody.

Obviously, corporations—large or small—that engage in research work do so with the hope of ultimate profits. If an enterprise does not develop new profitable activities, it cannot long stay in business. However, all experiments and all research efforts do not result in profit. Much of the cost has to be charged as a definite loss. There are instances on record where experiments costing several hundred thousand dollars have failed to produce any tangible results, and in one case, at least, considerably more than a million dollars has been expended over a period of years without any certainty whatever of commercial returns.

A Field where Big Corporations have Rendered Service

On the other hand, the research conducted by industrial companies has resulted in many discoveries that have definitely added comforts or enjoyment in almost every walk of life. In the field of electricity alone, we could hardly conceive of such things as the present incandescent lamp bulb, the radio, the telephone, or the electric household appliances, except as the products of the research and experimentation carried on by vast organizations.

To be sure, individual inventors have added a great deal to the progress of engineering in industry; but only in rare instances have they had the resources to make a commercial success of their inventions. Hence, in the field of engineering science and research, the much abused big business corporation has served a very definite purpose. It has pioneered where no other agency has had the necessary resources or the creative initiative.

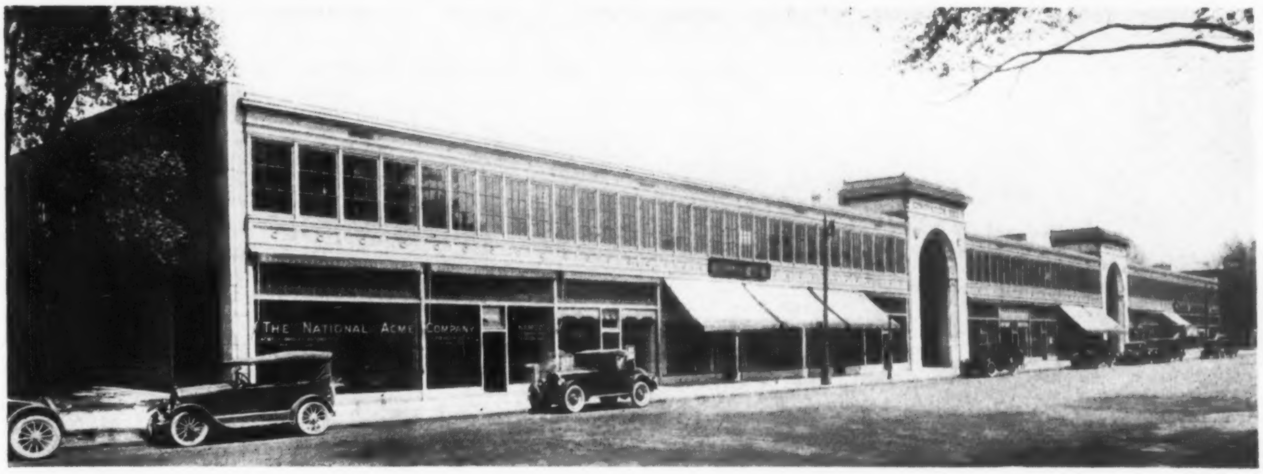
Tax Burden Here as Heavy as in Great Britain

The increasing tax burden is industry's most serious problem. It is placing a brake on American progress that is largely responsible for decreasing business and increasing unemployment. There is a general belief that we in this country are not so heavily taxed as are some other nations. In this we are mistaken. Even the President of the United States was mistaken when he recently said: "Taxes—local, state and federal combined—are nowhere near as high in this country as they are in any other great nation that pretends to be up to date."

These are the facts: Federal, state, and local taxes collected in the present fiscal year will amount approximately to \$13,700,000,000, according to computations of the National Industrial Conference Board, and budget estimates. Assuming our population as 128,000,000 people, this figures out very close to *\$107 in taxes for every man, woman, and child in the country.*

For the year ending March 31, 1938, the national taxes collected in the United Kingdom amounted to £841,000,000. To this should be added £176,000,000 for local taxes, a close estimate based on the latest published figures. Counting the pound at \$4.95 and the population of the United Kingdom as 47,000,000, curiously enough the tax burden in that country amounts to almost exactly \$107 per person, the same as in the United States.

Thus, by rapidly increasing taxes in the United States in the last few years, we have managed to pull abreast of Great Britain in the amount of taxes collected per capita; but we have also succeeded in increasing our national debt at a much greater ratio than Great Britain. Since 1930, Great Britain's national debt has increased \$1,700,000,000, whereas our Federal debt has increased \$21,000,000,000 in the same period. This means that while, at the present moment, we pay just as high taxes as they do in Great Britain, we will ultimately have to pay much more, since enough must be collected to pay that which we are now borrowing.



The Twentieth Annual National Metal Exposition

CONVENTION HALL, DETROIT, OCTOBER 17 to 21

ON Monday, October 17, the twentieth annual National Metal Exposition, held under the auspices of the American Society for Metals, will be opened in Convention Hall, Detroit, Mich. The exposition promises to be one of the largest ever held under the auspices of the Society. Nearly 250 exhibitors have arranged for space. The exhibits include not only metals and other materials of every kind—iron, steel, non-ferrous metals, and synthetic plastics—but also manufacturing and heat-treating equipment, including furnaces, welding and cutting equipment, machine shop tools, and auxiliaries and accessories of various kinds. Precision tools and instruments, refractories, abrasives, and rustproofing compounds will be represented among the exhibits.

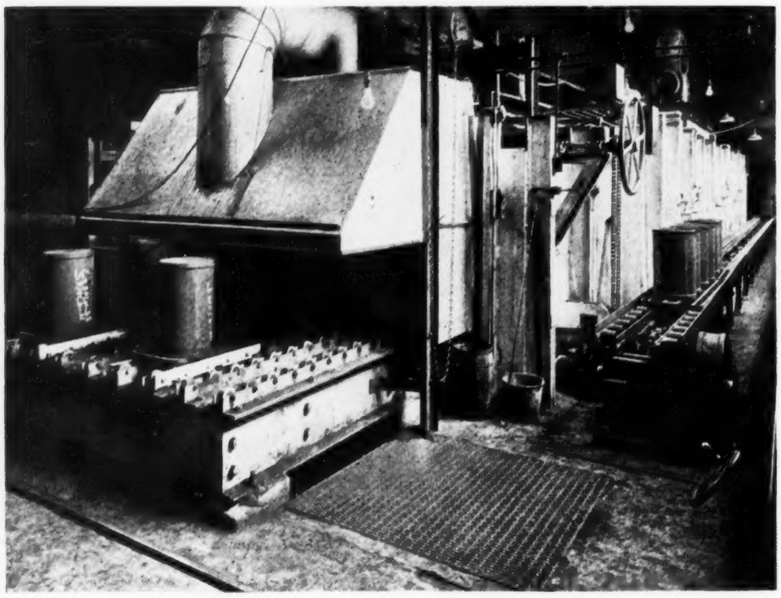
Those who have attended the National Metal Expositions in former years recognize that a visit to the exposition is truly a liberal education in the materials exhibited and the methods demonstrated. A great many of the exhibits will be shown in operation; and when actual operation is not possible, there will be photographs, working models, and motion pictures to aid the visitor in obtaining a vivid conception of the processes back of the exhibited product.

In conjunction with the National Metal Exposition, the American Society for Metals will hold its annual convention, with sessions morning and afternoon during the entire week of the exposition. The American Welding Society, the American Society of Mechanical Engineers, and the Wire Association will also hold meetings during the same week. In all, more than one hundred engineering papers will be presented, the program of the American Society for Metals alone including fifty-three papers.

Two educational courses are among the features of the program. One course begins at 4:30 each afternoon throughout the week, and covers the machineability of steels and non-ferrous metals. The other course, at 8 P.M. on Monday, Tuesday, and Wednesday, October 17 to 19, will cover pyrometry. Another feature of the meeting will be a two-day symposium on "Effects of Alloying Elements on the Hardenability of Medium and Low Alloy Steels."

The visit of some two hundred members of the Iron and Steel Institute and the Institute of Metals of Great Britain will lend especial interest to this year's convention and exposition. The Edward De Mille Campbell memorial lecture, delivered by an outstanding authority in the metal field, is an annual feature of the convention of the American Society for Metals. This year's lecture will be by A. L. Boegehold, head of the metallurgical department of the General Motors Corporation, Research Laboratories Division. This lecture will be delivered in connection with the annual meeting of the American Society for Metals, Wednesday morning.

Carburizing—An Old Process



A Review of Methods Formerly Used and a Description of New Developments that Have been the Cause of Recent Great Improvements in Carburizing Methods

Fig. 1. Four-row Continuous Counterflow Box Type Furnace

As defined by the metallurgist, carburization is the result of heating iron or steel to a temperature below its melting point in the presence of a solid, liquid, or gaseous material which decomposes so as to liberate carbon when heated to the temperature used. In this way, it is possible to obtain by the gradual penetration, diffusion, or absorption of the carbon by the steel, a "zone" or "case" of higher carbon content at the outer surfaces than that of the original object. The product obtained is always characterized by the fact that the concentration of carbon in it is highest at the surface and diminishes toward the interior or core of the piece, until it reaches the value that it originally had in the untreated iron or steel.

When a carburized object is rapidly cooled or quenched in water, oil, brine, etc., from the proper temperature, this case becomes hard, leaving the inside of the piece soft, but of great toughness. We thus have a second step which is generally implied when carburizing is spoken of—that is, casehardening.

Carburizing or casehardening of steel is done in order to obtain a hard outer surface that is very resistant to wear, combined with a tough, shock-resistant core inside the hard shell. This process makes it possible to start with a soft piece of steel that can be easily machined or shaped, and finish with a piece that will stand up under severe stresses.

The first indication of a process for adding carbon to soft iron in order to make a harder metal dates back to a period around 1550. It cannot be established with certainty whether in the Middle Ages, or in earlier times, a similar process was known.

It is probable that the manufacturers of daggers, arms, needles, etc., may have known such processes from very ancient times, but kept them secret, transmitting them only verbally from father to son. Such a belief seems confirmed by some legendary accounts from the beginning of the Middle Ages. It is probable that the manufacture of swords in ancient times was conducted somewhat as follows: The craftsman took a bar of soft iron, heated it in his forge, hammered it out into a long piece, reheated it and folded it, hammered and folded it again, perhaps a hundred times, and finally obtained a thin bar of "steel" which had picked up carbon from the coals of the forge after many heatings, which small amount of carbon from each heating was worked into the piece by the repeated foldings and forgings.

In the sixteenth century, carburizing processes were known, based on the use of carburizing powders. These were used exclusively with the idea of taking a soft iron object, which after forming, was subjected to a carburizing treatment in order to obtain a shallow zone of steel that could be hardened by quenching. In the seventeenth century, bars of soft iron began to be treated in this way, so as to make a steel that could be hammered or forged.

The adding of carbon to soft iron to make steel gradually led to the development of the present processes of making steel. At the same time, the rapid improvement in mechanisms brought before the producer of the metal the problem of obtaining a large number of parts having maximum surface hardness, combined with the minimum of brittle-

Modernized Through Research

By F. D. WIDNER
Research Engineer
Surface Combustion Corporation
Toledo, Ohio

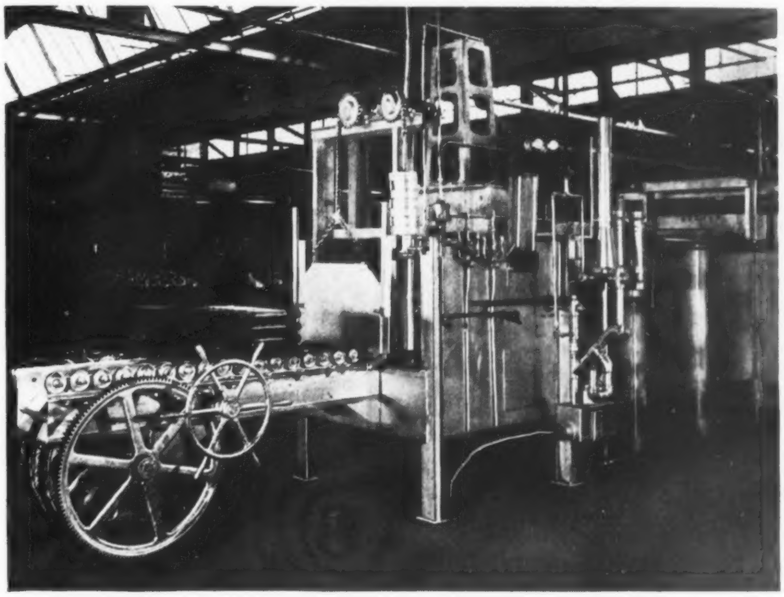


Fig. 2. Discharge End of Furnace Equipped with a Cooling Zone

ness. This caused casehardening to assume great importance.

Early in the eighteenth century, the first researches were carried out with various carbonaceous mixtures that would yield carbon to the iron or steel object. Many mixtures were used consisting of fantastical combinations of organic substances, such as hoofs, hides, bones, dung, and urine of specified animals. We should not wonder at this, since many carburizing mixtures in the first part of the twentieth century were on the market under the strangest names, and under curious contracts of secrecy, which were no less fanciful than these earlier ones—nor did they give better results.

Soon many of the complex mixtures were abandoned and only powdered wood charcoal was used. Even though it had been proved that carburizing consisted in the diffusion of carbon alone into the iron, the opinion continued to be held that by the addition of suitable foreign substances to the wood charcoal, it was possible to greatly shorten the time necessary for a given amount of carburization. Thus in 1861, a new "mix" was introduced, based on the use of wood charcoal and barium carbonate, which is still widely used today.

The earliest known practice of treating the bars of soft iron was to pack them in boxes made of slabs of refractory material, and to surround them with a powdered carbonaceous material closely packed around them. From this packing method, we derive our present-day terms of "pack" or "box" carburizing. From boxes built of refractory slabs the trend of box development was a gradual one, through boxes made of cast steel, sheet steel (bolted or welded together), up to the present practice of using cast or sheet alloy steels, which last longer than the earlier plain steel boxes.

The life of boxes depends greatly on the temperature at which carburizing is conducted, the composition of the atmosphere of the furnace in which they are used, and the physical treatment to which they are subjected during the charging and discharging of the furnace. In any case, the boxes must be furnished with a cover of the same material as the box, with edges so shaped as to insure good closing. After being placed in position, the edges are sealed with fireclay.

The dimensions of the boxes must be such that the objects being treated are easily contained in them; there must be free space all around the object to be filled with compound. This will provide a layer of compound that will be thick enough to insure uniform carburization. It is always advantageous to have the boxes of minimum size, while keeping the above thought in mind, because the larger the box, the longer the time necessary for the heat to penetrate from the outside to the center and for the temperature to become uniform throughout.

Some of the troubles encountered because of the slow rate of heat penetration from the outside to the center of large boxes are warping of the objects, non-uniformity of carburizing, and increased length of time necessary to obtain a given depth of "case."

Many types of box carburizing furnaces have been used. The earliest of these were heated with solid fuel or coal and sometimes were as complicated in construction as the carburizing agents or mixtures used in them were fantastical.

Today we have "in-and-out" or batch furnaces, continuous furnaces, and counterflow continuous types. These are heated by gas, electricity, or oil. "In-and-out" or batch types are those in which the boxes are placed in the furnace and remain there for the length of time necessary to produce the required "case."

The continuous type furnace is that which operates continuously, with a succession of boxes. The box of work is pushed into a long furnace just inside the door, at definite time intervals; the length of this interval is such that the total time in the furnace gives the desired case. The length and size of the furnace depend upon the amount of work to be carburized. From some continuous furnaces, the boxes are pulled out at the same temperature as that used for carburization, and the work quenched directly from the furnace. In other instances, depending upon the metallurgical requirements, the boxes are pulled out into the air to cool; or the furnace may be built with a cooling zone, depending upon the rate of cooling desired, and then the work reheated for hardening.

Fig. 1 shows a "four-row" counterflow type continuous box type furnace in which two rows of boxes travel in opposite directions, that is, boxes are pushed in at either end of the furnace at the desired time interval. In this type of furnace, there is a considerable fuel saving, because of the fact that the heat from the row of boxes coming out of the furnace at either end tends to heat up the boxes entering the furnace.

Owing to the fact that much labor is required for the proper packing of the boxes, and that much attention must be given to the mixing and storing of carburizing compound, which requires considerable space, and also because alloy boxes are clumsy and costly, manufacturers began to look around for cleaner, simpler, and less costly methods of carburizing.

During the vast research for other materials suitable for carburizing, excellent results were obtained as early as the first part of the nineteenth century by using gas or gaseous hydrocarbons instead of wood charcoal. However, the sources of gas were costly in the early days, so that these processes did not find wide application until many years later, when it became possible to exclude air completely from the carburizing boxes.

Probably the first commercially practical types of gas carburizers were the horizontal rotary and the vertical pit type. The rotary type employs a carburizing box which is cylindrical in shape, commonly known as a retort or muffle, which rotates within the heating chamber. The retort is placed horizontally and has a gas-tight lid at one end which projects out of the heating chamber. By removing this lid, the objects to be carburized can be readily packed in, or taken from, the retort. The other end is closed except for a small opening through which the gas enters. The gas leaves the retort through another smaller opening in the lid, this smaller opening creating a slight pressure in the retort to keep air out. After the work is charged, the length of time, mixture of gas, and temperature to be used are determined by the kind of case desired on the steel or part being treated. In this type, the retort revolves slowly, thus allowing the work to be agitated, so as to cause all surfaces to be exposed to the gas and thus obtain a uniform treatment.

Pieces that have been successfully treated with this equipment are ball and roller bearings, chain links, small axles, bolts, thread cutting dies, etc., of round or cylindrical form. Flat washers, plates, and similar parts tend to lodge themselves on the bottom of the retort and slide, so that all faces of the parts are not subjected to a uniform action of the carburizing gases. Very large pieces like gears undergo, by rotation of the retort, successive "falls," which may result in harmful shocks.

In the vertical, pit type furnace, the retorts vary in size and dimensions, but are stationary and placed vertically in a pit. A different reaction takes place than in the rotary furnace (where the work "circulates" in the gases), since the work is sta-

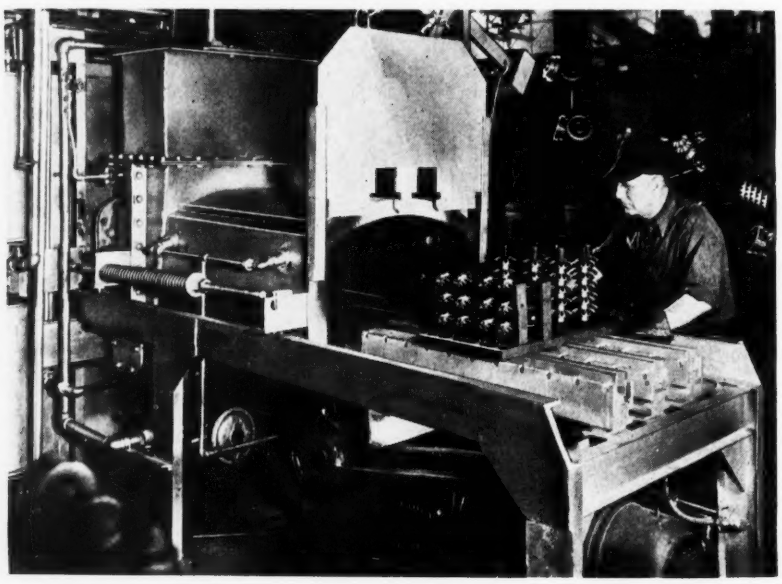


Fig. 3. Tray of Work Ready to be Pushed into the Charge Vestibule of the Furnace, from which it is Pushed into the Muffle by a Gravity Dog Pusher

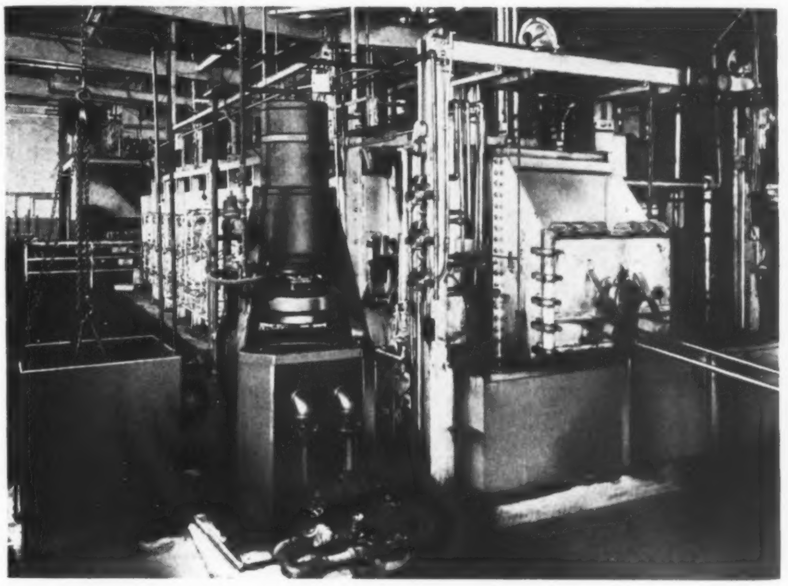


Fig. 4. Discharge End of Furnace. An Entire Tray Load of Smaller Pieces is Quenched Directly, Larger Pieces being Quenched Individually in a Press

tionary and the gases circulate around it. In loading such a retort, care must be taken, just as in pack carburizing, to insure ample space between the objects being carburized, in order to permit the necessary gas circulation for obtaining good uniform carburizing. This type of furnace is applicable to long large shafts, drills, rings for ball bearings, gears, etc., of shapes that cannot be rolled in a rotary type of furnace.

Just as increased rates of production led to the use of larger continuous furnaces in place of batch furnaces, so the trend of gas carburizers has been from batch operations, as obtained with pit and rotary furnaces, to larger, continuous types.

Eutectrol Type Continuous Gas Carburizers

After considerable research work and study in the laboratory of the Surface Combustion Corporation, a continuous process was worked out that lent itself well to the demands of the modern trend of continuous movement of materials through a factory. This process was called the Eutectrol process.

As mentioned, in box carburizing, the work is packed in small alloy steel boxes with carburizing compound, the boxes then being pushed through the heating chamber. In a continuous gas carburizer, we roughly simulate the same condition, except that the box becomes a long and large one, roughly 2 1/2 feet wide and 1 foot high; the length is determined by the volume of production. This box, or "muffle" as it is properly known, is put in a heating chamber which has burners firing over and under it, so placed as to obtain proper heating. The work is loaded on alloy steel grids or trays, properly spaced by fixtures or supports to allow gas circulation around the surfaces to be carburized; these trays are then pushed into and through the muffle at the time intervals required to produce the desired case.

Taking the place of the covers or lids in box practice, there is a mechanically operated gas-tight valve door at one or both ends of the muffle. Outside of each valve door is a small chamber known as a vestibule, which is closed by another door that is hand-operated, but not gas-tight, at the charge end, and by one that is mechanically operated at the discharge end. These vestibules are generally purged to keep air out of the muffle when the muffle valve doors are opened for loading or removing work. Fig. 3 shows a tray of work, ready to be pushed into the charge vestibule, from which it is pushed into the muffle by a gravity dog pusher.

Types of Continuous Gas Furnaces

There are three types of continuous gas furnaces: (1) Direct quench, mechanically operated; (2) direct quench, manually operated; and (3) cooling zone type. The first type has no hot-valve door or vestibule at the discharge end, but is built with the carburizing chamber directly connected to the quenching tank. The work, after being loaded by the operator at the charge end and placed in the charge vestibule, is mechanically handled during the carburizing, quenching, washing to remove the quenching oil, and drawing, after which it is manually unloaded. In the drawing furnace, the work is heated to not over 375 degrees F., in order to relieve any internal strains in the metal caused by the quenching without much reduction in the newly acquired hardness. This type of installation is typical of the latest trend of automotive heat-treating to the single-quench gas-carburizing treatment.

Not all parts are to be given only one quench. Some parts require a different treatment, depending on the steel and the service to which they are to be subjected. With a double quench, the first one, whether it is made directly from the carburizer or after cooling and reheating, gives the core strength and toughness, but leaves the case brittle, and the second quench refines the case, making it hard and tough.

The second type of continuous gas furnace is equipped at the discharge end with a hot-valve door, having a holding chamber or vestibule outside

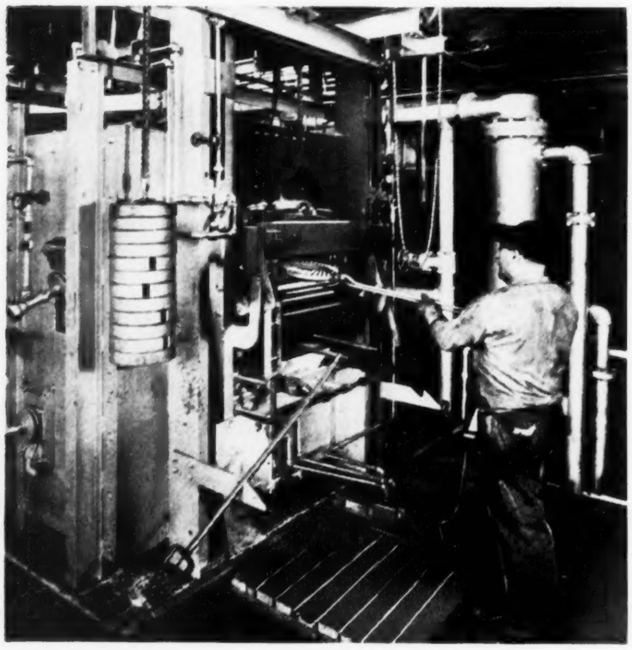


Fig. 5. Operator Removing a Ring Gear for Quenching

of it, which is capable of being maintained at any desired temperature for quenching. In this chamber, the work is held until it is ready to quench, when it is quickly taken into the air and placed in the quenching tank or machine. (See Fig. 5, which shows the operator removing a ring gear through a small slot door in the holding chamber, preparatory to placing in the quenching machine.)

The method of quenching the work from the vestibule after pulling it from the carburizing chamber that is inside the hot-valve door varies. In some cases, the work is quenched piece by piece from the vestibule. In others, the trays are pulled on a buggy and wheeled to the quenching tank, in which they are quenched as a mass or singly. Another method is to pull the work directly on a dumping mechanism, from which it is dumped as a mass into the quenching tank. Whenever it is desired to have the work remain in the chamber, so as to come to a lower temperature before quenching, and also when the work must be machine-quenched piece by piece, it is necessary to "purge" the vestibule with a gas that will prevent decarburization.

When the work is to be removed from the holding chamber piece by piece for quenching in machines, there is generally a slot door on the side of the vestibule or in the large vestibule door, as shown in Fig. 5. By this means, the amount of heat loss and air infiltration is reduced to a minimum. If repeated openings of a large door occurred, this loss would be considerable. By this means, the amount of gas required to maintain a definite heat in the vestibule and the right atmosphere in the muffle to prevent decarburization by air infiltration, is greatly reduced.

Through such a typical installation, automobile transmissions and differential gears are run. There is a small slot door on the side of the purged vestibule through which ring gears are removed singly for quenching in a quenching machine. The transmission gears, shafts, etc., are pulled through the large door opening at the end of the muffle on a quench-buggy in a hooded quenching tank. This buggy is then mechanically lowered into the tank, pulled over away from the hooded portion of the tank, and raised after the work has remained a sufficient time in the oil. The work, still on the trays, is then pushed through a machine for removing the quenching oil and placed in the drawing furnace. Finally, the work is placed on a conveyor which conducts it to the inspector's bench. Fig. 4 shows the discharge end of the furnace.

The third type of continuous gas carburizer is that in which the box or muffle is made much longer and extends outside the heating chamber into the air. While the heating chamber about the muffle consists of a brick-lined steel shell, the extended portion of the muffle merely has the steel shell around it. At the end of this extension, the muffle is closed by a cold-valve door and vestibule, similar to the one at the charging end of the furnace. This vestibule, like the charge-end vestibule, is purged with a non-inflammable gas to keep air out of the muffle when the valve doors are opened. This is known as a cooling zone; the trays of work are pushed through the carburizing section and then through the extension, which allows the work to cool in the carburizing atmosphere before removal for subsequent reheating and quenching. Fig. 2 shows the cooling zone end of this type of furnace.

In a coming number of MACHINERY additional information on gas carburizing will be given.

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Die-Castings Offer the Designer New Opportunities

COMPETITION in materials and production methods is keener than ever; stampings, sand castings, plastics, forgings, and die-castings are all clamoring for the attention of the design engineer. This competition has apparently been a strong incentive to the country's commercial die-casters, for the past year has witnessed developments that outclassed by far any other single year since the introduction of die-castings as an important factor in engineering production. Of the various metals employed for die-castings, zinc alloy has been the one most used by the designer, both because of the flexibility of design that it permits and because of the physical characteristics of the metal. A few outstanding zinc-alloy die-casting applications of the last twelve months will, therefore, be briefly reviewed.

Probably the most impressive application from the standpoint of design flexibility is the new time-recorder introduced by the International Business

Machines Corporation. This recorder, shown in Fig. 1, is handsomely encased in a stamped steel housing, but otherwise it is composed almost entirely of zinc-alloy die-castings, seventy-one in all. The major consideration in this design was to obtain compactness. For this requirement, die-castings were especially suited because (1) the intricacy of design that is possible with die-castings enabled the engineers to use one part where three or four might otherwise have been required; (2) the ease of casting unusual shapes made it possible to utilize every available cubic inch of space; and (3) thin sections of great uniformity could be cast, thus permitting small clearances between the operating parts. The use of zinc-alloy die-castings not only made it possible to reduce the number of parts materially, as compared with the preceding model, but there was also a sizeable reduction in manufacturing cost.

Fig. 1. There are Seventy-one Die-cast Parts in this Time-recorder

Fig. 2 shows a die-cast rotor for an oil-pump which embodies the principle of the universal joint. This rotor is composed of three zinc-alloy die-castings, and functions between driving and driven shafts set at an angle of 30 degrees. The four wedge-shaped rotor chambers are opened and closed in succession as the shaft revolves. Each, in turn, draws in and discharges the fluid being pumped. The three die-cast parts are ready for use as cast, no machining being required. All fits are exact and the holes and keyways are cored to size in the casting. The smooth surfaces of the casting, as it leaves the mold, permit of silent and efficient operation. Die-casting appeared to be the only possible means of commercially applying this idea to an oil-pump.

Fig. 2. Die-castings Used in Making a Novel Universal-joint Oil-pump

If anyone had suggested only a few years ago the manufacture of a die-cast lawn mower, his practical common sense might have been questioned. Today, however, Clemson Bros. have produced a modern lawn mower that is almost entirely made from zinc-alloy die-cast parts. The castings not only have provided economies through the elimination of machining and assembling operations, but have proved efficient and dependable for the purpose as well. Typical of the flexibility of design in this instance is the reel; the steel cutting blades on the reel are cast as inserts in the supporting zinc-alloy member. This type of construction is very inexpensive, but insures a permanent fastening.

If space permitted, there are hundreds of recent die-casting applications that might be mentioned. The three mentioned were selected as typical of the use of die-castings in three widely separated fields. The use of these castings in the automotive field is well established, but few designers realize that the die-casting process has penetrated into practically every major industry. The producers of hardware, radios, electrical appliances, industrial equipment of many types, toys, business machines, etc., have all recognized the importance and value of die-castings in their products. The design engineer who has not yet taken advantage of the possibilities of zinc-alloy die-castings has a pleasant experience in store—for it may solve simply some of his more difficult problems.

Savings in Tool Costs through

By the Use of Modern Heat-Treating Equipment, the Bassick Company, Bridgeport, Conn., has Found it Possible to Greatly Increase Tool Life and Reduce Tool Costs

Fig. 1. Loading Flasher-ring Dies into a Vapocarb-Hump Controlled-atmosphere Furnace at the Bassick Co.'s Plant

ONE of the ways in which important savings can be made in a manufacturing plant is by increasing the production per tool. Many tools, such as punches and dies for simple forgings, may be considered "inexpensive," because they can be made from low-priced steel with comparatively little labor. If they are used in reasonably large quantities, however, the total outlay may be astonishingly large.

The production per tool can, of course, be increased in various ways. Sometimes the tool may be redesigned to give better results; again, a change in the tool steel used may be advisable. Often, however, the answer lies in better heat-treatment —in providing equipment for the heat-treater so that he can work with a precision equal to that of the toolmaker. Why should not the heat-treater be able to produce better results if he can reproduce, with fair accuracy, the rate of heating, the furnace atmosphere, the location of the critical temperature, the temperature and pressure of the quench, the drawing time and temperature, and other variables that affect the results? As a matter of fact, he often can.

This is well demonstrated by the experience of the Bassick Co., Bridgeport, Conn. The tool engineers of this company took an inexpensive die, and by planning its heat-treatment with care and using equipment providing real control of the heat-treat-

Fig. 2. The Life of These Flasher-ring Straight Carbon-steel Dies has been Increased over Three Times by Improved Heat-treatment

ment conditions, they stepped up the life of the die from an uncertain twelve hours to a certain forty hours. As a result, in the cost of this one simple tool $1500 a year was saved.

The die is a "flasher ring," as shown in Fig. 2; it is used on cold-headed slugs for steel balls assembled in Bassick caster bearings. One die is fixed horizontally on the flasher machine, while the other rotates concentrically above it, so that the milled grooves coincide. The slugs are fed into the grooves for one stage in the forming of the balls. This work is hard on the dies, and for that reason, the tool engineers were constantly alert to improvements that would increase the die life. About three years ago, they came to the conclusion that the installation of improved heat-treating equipment and the use of the latest technique in heat-treatment would be advantageous and profitable.

Among the factors involved in producing a die with long life, these four are of importance: (1) The tool steel employed; and the methods used for (2) hardening; (3) quenching; and (4) tempering. The inter-relationship between these four factors was never lost sight of, although by necessity, each will be dealt with separately in this article. The increase in tool life is due as much to the careful coordination of these factors as to any other one consideration.

The tool steel used was S A E 1085—a water-hardening type containing about 0.90 per cent carbon. It was decided to continue the use of this steel, because it is relatively inexpensive, easy to work, and well suited for this kind of tool.

The hardening furnace installed is a Vapocarb-Hump type, made by the Leeds & Northrup Co., Philadelphia, Pa. This furnace supplies the heat-treater with three controls over the steel while it is heated for quenching. One of these controls is the well-known "Hump" feature. When each individual tool (or furnace charge, if several tools are charged at once) reaches the critical temperature, a "hump" forms in the record on a Micromax recording controller, which is part of the equipment. Thus the heat-treater no longer depends solely on temperature as an indication of the heat-treated structure and quenching point. He quenches from the "hump," because he knows that it is as accurate an indication as a cross-section of the structure of the steel at this point would be.

The temperature control of the Vapocarb-Hump furnace will regulate the rate of heating rather than the final temperature, if this is desired. When employed as a rate control, while the tool is heating, it actually uses the tool temperature itself to shut off the heating whenever the temperature rises faster than is desirable. This control is set by means of a dial, and after once having been set, is automatic.

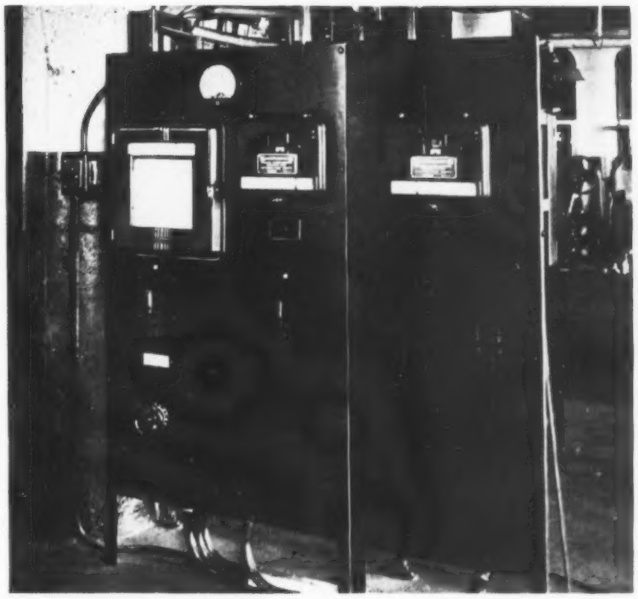


Fig. 3. Control Panel for the Vapocarb-Hump and Homo Furnaces Used in Heat-treating Dies in the Bassick Plant

The atmosphere of the furnace is a carbonaceous gas called "Vapocarb." It is made by cracking a special Vapocarb fluid in a small automatically operated electric furnace which is an accessory to the Hump furnace. This gas can be used in any amount desired, from that necessary to protect the less oxidizable steels up to that needed for high-chromium, high-carbon alloys.

In Fig. 1 the heat-treater is shown loading flasher-ring dies into the furnace. The flame at the rear is from the spent Vapocarb gas, which burns at the vent behind the furnace lid. The cracking furnace is at the right of the heat-treater, almost concealed from view. Both furnaces are electric, having a maximum combined power demand of 10.7 kilowatts.

The quenching fixture can be seen projecting over the brine tank at the extreme right in Fig. 1. By means of this fixture, brine is pumped, under considerable pressure, directly into the toothed groove of the flasher die, providing a very fast quench, uniform along the entire working surface.

Improvements in tempering to accompany the improvements in heating for hardening and quenching were made possible by installing a Homo forced convection tempering furnace which employs uni-directional circulation of air, with a maximum power demand of 12 kilowatts to operate at a temperature up to 1200 degrees F. One of the features

in the economical operation of this furnace is that it can be shifted in a few minutes from one temperature to another, either higher or lower. It is provided with automatic overheat protection, a centrifugal fan, and the new type Homo heater, recently developed. For the convenience of the operator, the Hump and Homo control panels, as shown in Fig. 3, were installed at the end of the room, where the heat-treater can see them clearly at all times.

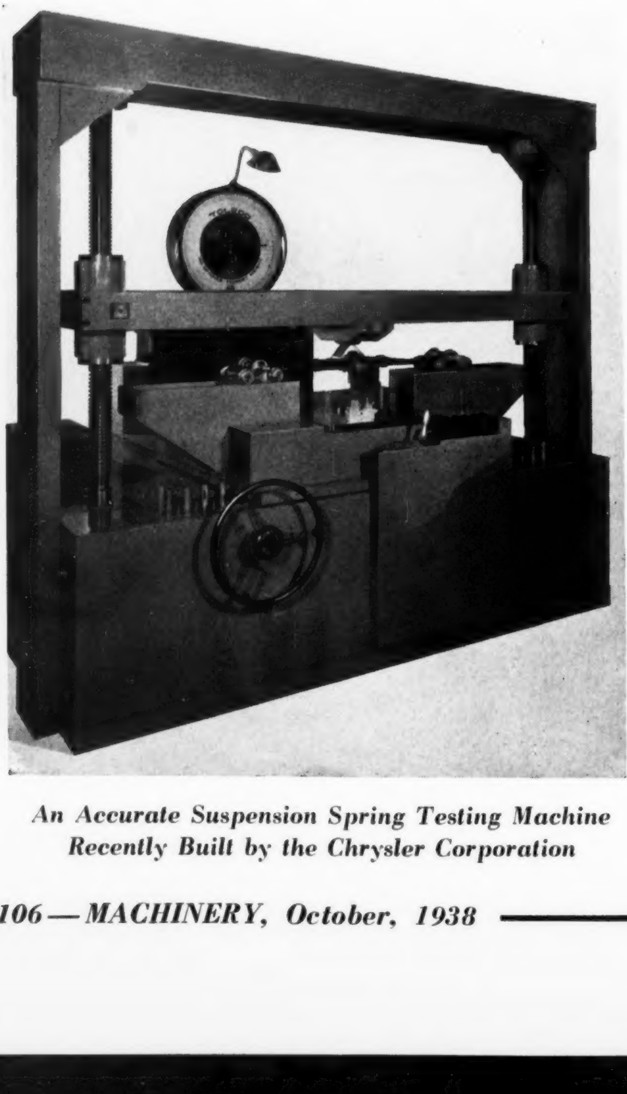
The improvement that these changes effected was apparent in the first ring dies heat-treated with the new equipment. The productive die life, which had varied from four to twelve hours, jumped to forty hours; and the uniformity is such that each die is now regularly being run forty hours.

The possibility of "budgeting" tool life as one budgets other expenses is, perhaps, one of the most striking advantages of this improved heat-treating practice. The increased die life saves at least three dies a week, which, at $10 per die, is approximately $1500 a year. This is slightly more than one-half the cost of the entire installation. Furthermore, these savings are made in a comparatively few hours each week; most of the time the new equipment is used for heat-treating other tools.

The maintenance cost of the equipment has proved to be very small. There have been no repairs necessary in over two years. Even if a high rate of depreciation were charged off annually, it is apparent that the equipment would pay handsome dividends in direct savings, to say nothing of the indirect savings due to fewer die changes at the machines, dependability of the tools, and uninterrupted production.

Chrysler Spring Testing Machine

A suspension spring testing machine that is believed to be the most accurate device of its kind used in the automotive industry has just been completed by the Research Laboratories of the Chrysler Corporation, Detroit, Mich. This machine, it is stated, determines the test values required within limits ten times more accurate than has previously been commercially possible. The machine is practically automatic, one man operating it by pushing a few buttons. Loads on either coil or leaf springs up to 5250 pounds can be determined in a few seconds. A platform scale of the springless type is used as being the most dependable device for measuring the load. A motor-driven mechanical system was chosen to apply the load to the spring in order to hold the spring in the desired position over a definite period of time.



An Accurate Suspension Spring Testing Machine Recently Built by the Chrysler Corporation

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Importance of Correct Welding Rod

In a recent number of *Oxy-Acetylene Tips*, the importance of the use of a correct welding rod for obtaining suitable welds, especially in high-strength alloy steels, is emphasized. Experience has proved time and again that such welds can be produced only if high-quality rods, having the correct composition, are used. The quality of a weld—its strength, ductility, corrosion resistance, grain structure, machineability, surface finish—is dependent just as much on the rod as on the skill and technique of the operator. The chemical elements of the rod must be included in exactly the right proportions so that the resulting weld will have certain definite characteristics.

Today there are available a variety of steel and alloy steel rods to meet all welding requirements. These include drawn iron, high-carbon steel, high-test steel, low-alloy steel, nickel steel, manganese steel, and columbium-bearing stainless steel rods. However, many of these rods are used only under special conditions, since the high-test steel rods, or so-called "general purpose" rods, have proved well adapted for welding the majority of the low-alloy and medium-alloy steels.

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
High-strength Cast Iron	**Acmeloy Metal**	A group of cast irons with a composition of: Carbon, 2.75 to 3.35 per cent; silicon, 1.00 to 1.75 per cent; manganese, 0.65 to 1.75 per cent; sulphur, less than 0.15 per cent; and phosphorus, less than 0.20 per cent. By varying composition, physical properties can be altered to suit requirements. Tensile strength: As cast, 30,000 to 60,000 pounds per square inch; heat-treated, 75,000 to 85,000 pounds per square inch. Compressive strength: As cast, 125,000 to 175,000 pounds per square inch. Brinell hardness: As cast, 175 to 275; heat-treated, 400 to 600.	Cast irons in this group are claimed to be free from hard spots, white edges, and corners, as well as spongy areas, and to be uniformly hard throughout all sections, regardless of the thickness. They are, therefore, especially suitable where machining qualities and dependability as to strength are important factors.
Welding Rod	**Alladin**	Welding rod suitable for welding white-metal die-castings that have formerly been considered unweldable. This rod is said to produce a weld that has as great strength as the base material.	Used in welding shops for welding die-cast parts such as radiator grilles, lamp brackets, carburetor bowls, ornaments, and other die-cast products. Used with the oxy-acetylene flame.
Synthetic Plastic	**Bakelite, Impact-resistant**	Plastic molding materials having a high resistance to shock or impact; made in four classifications to resist different degrees of shock; also resist many chemicals and water, and have good dielectric properties.	Suitable for hand-set telephones, golf-club heads, football-shoe cleats, instrument cases, junction boxes, oil-well equipment, and other parts requiring relatively high shock resistance.
Synthetic Plastic	**Bakelite Polystyrene**	A thermoplastic molding material that was primarily developed for use as an electrical insulator. Tests made indicate that no noticeable changes occur in the electrical properties of the material with an increase in either temperature or humidity. Tensile strength, from 5000 to 5500 pounds per square inch; impact strength, from 0.14 to 0.16 foot pound.	Since the material was developed primarily as an electrical insulator, it offers marked advantages for use in many electrical products and equipment.
Malleable Iron	**Belmalloy**	A pearlitic malleable iron having physical properties developed by an electric melting and continuous annealing process that are similar in many respects to the properties of 0.40 per cent carbon cast steel. The tensile strength ranges from 70,000 to 80,000 pounds per square inch; yield point, from 45,000 to 50,000 pounds per square inch; and hardness, from 179 to 207 Brinell. Can be machined more easily than steel castings, although not so easily as regular malleable-iron castings.	Suitable for applications where high tensile strength, considerable hardness, comparative ease of machining, and freedom from internal stresses are of particular value in castings.
Babbitt	**Bunting Genuine**	A tin-base babbitt having high load-carrying capacity and ability to withstand high temperatures.	Suitable where high speeds, severe vibration, heavy shock and impact loads are met with.
Cellulose Plastic Coating	**Cellucraft**	A plastic coating for metal, wood, and rubber, applied by spray guns; available in bright colors, pastel shades, "metal tones," and other effects, obtained by pigmenting the coating material. A similar material known as "Macoid" is applied by dipping.	Applicable to the finishing of automobile hardware, such as window regulators, door handles, and control knobs; die-castings in general; and molded rubber steering wheels.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Colored Strip Steel	**Colorstrip**	A cold-rolled strip steel finished in any desired color, available in widths from 1/4 to 8 inches, and in thicknesses from 0.008 to 0.042 inch. Can be drawn or formed without marring color.	Suitable for use wherever a formed part would ordinarily be colored after fabrication.
Corrosion-preventive Compound	**Corol**	A rust-preventive preparation which may be sprayed on metal parts or in which the parts may be dipped, to prevent corrosion. Can be applied to metal surfaces even when they are damp, as it will displace any water that may be present. The rust-preventive film can be easily removed.	Used by manufacturers of airplanes to prevent corrosion on metal parts, especially when exposed to dampness and sea air; particularly suitable for metal parts to be exported.
Alloy Resembling Hardened Copper	**Cupaloy**	An alloy that can be obtained with elastic strength of 35,000 pounds per square inch and with remarkable heat and electrical conductivity characteristics. Withstands temperatures of 750 degrees F. with relatively little permanent softening. Rate of wear under severe tests is only 40 per cent of that of hard-drawn copper.	Used in making continuous welds that are unusually strong and gas-tight, as in welding streamline trains, cooling systems for electric refrigerators, etc. When used for welding tips, the alloy has a service life several times longer than that of pure copper, and from 50 to 200 per cent longer than that of other low-resistance alloys.
Bronze	**D-H-S Bronze**	Bronze possessing an unusual combination of ductility, hardness, and strength; available in both castings and forgings; made in four grades with tensile strength ranging from 90,000 to 120,000 pounds per square inch, and Brinell hardness from 185 to 250; resistant to certain acid solutions.	Is suitable for withstanding shocks, heavy loads, and the wear that ordinarily occurs in heavy-duty applications—as, for example, spur, bevel and worm gears; trunnion and other heavy-duty bearings; and valve stems, bodies and seats.
Alloy Cast Iron	**Domite**	Nickel-alloy cast iron from which it is possible to cast die members to such close dimensions that punches and dies will fit within small fractions of an inch, even without filing. Dies cast from Domite have been found to produce at least 30,000 stampings before redressing was necessary.	Used for drawing and stamping dies for automobile fenders, hoods, running boards, hub caps, and accessory parts. Labor in making dies has been reduced to less than one-half by the use of this cast iron.
Synthetic Plastic	**Durez 113 Black**	Molding material having a deep rich black color and a smooth luster, which can be hard-buffed without showing filler spots.	Developed especially for radio cabinets and other large housings where appearance is important.
Synthetic Plastic	**Durez 1590**	Plastic material claimed to have an impact strength five times greater than that of standard molding materials; is easily molded and preformed.	For industrial applications requiring high resistance to shock combined with other properties characterizing molded plastics.
High-strength Flat-rolled Steel	**Dyn-El**	A high-strength flat-rolled steel with unusual capacity to resist fatigue, impact, and corrosion. Can be produced at low cost. Permits safe working loads of 25,000 pounds per square inch. Elastic limit, 58,000; tensile strength, 72,000 pounds per square inch; elongation in 2 inches, 28 per cent; and reduction of area, 60 per cent.	Suitable for railroad rolling stock, permitting reduction in dead load at no decrease in strength or service life; for trucks, buses, and other automotive equipment, to obtain reduced weight with increased strength; and for stationary structures, to obtain increased strength, longer life, and resistance to corrosion.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Monel Metal	**Ebonized Monel**	Monel metal with an ebony finish obtained through an oxidizing operation. The metal is identical with regular Monel except for the lustrous blue-black finish. It is immune to rust and resists discoloration at relatively high temperatures.	Suitable for applications where appearance must be maintained at temperatures up to 1400 degrees F., as in reflectors, deflectors, element pans, etc., of electric heating units.
Synthetic Plastic	**Flamenol**	Synthetic insulating compound similar to rubber in its characteristics, but does not contain rubber and is not combustible; can be compounded, filled, calendered, and extruded in much the same manner as rubber.	Used as an insulation on cable because of being highly resistant to moisture, acids, alkalies, and oils; is available in a variety of colors.
Preparation Preventing Adhesion of Weld Spatter to Metals	**Glyptal No. 1294**	A preparation that is preferably sprayed rather than brushed on work to be welded, and can be applied without harm to any metal surface, including polished stainless steel. On surfaces that are to be painted, it serves as an excellent priming coat.	Used for preventing the adhesion of weld spatter to metals that are to be welded. It will not make the weld hard or brittle.
Alloy Steel for Dies	**Graph-sil and Graph-mo**	Alloy steels in which part of the carbon content is in the form of free graphite, thereby combining the more desirable features of cast iron with the high strength of steel; easily machined; high surface hardness is obtained through simple heat-treatment, making it suitable for the making of punches and dies in one piece; has unusual resistance to wear and high resistance to impact; can be welded satisfactorily by the resistance method.	Graph-sil is a water-hardening grade used for dies that are reasonably uniform throughout, and for parts on which stock can be left for grinding after heat-treatment. Graph-mo is an oil-hardening grade used for dies and punches that are of non-uniform section and must not change in heat-treatment.
Corrosion-resistant Alloy	**Hastelloy B**	Alloy composed of nickel, molybdenum and iron, having a tensile strength in the forged, rolled, and fully annealed state of 135,000 to 140,000 pounds per square inch, with an elongation of 44 per cent in 2 inches. Is also unusually strong at high temperatures, and highly corrosion-resistant.	Developed primarily for equipment handling hydrochloric acid in all concentrations and at temperatures up to and including the boiling point; also resists sulphuric, phosphoric, and acetic acids, as well as non-oxidizing acid chloride solutions.
High-strength Steel	**Jal-Ten**	Open-hearth manganese copper-bearing steel with high resistance to weather corrosion. Minimum tensile strength, 80,000 pounds per square inch; minimum yield point, 50,000 pounds per square inch; minimum elongation in 2 inches, 20 per cent; minimum Brinell hardness, 160. Three times greater resistance to atmospheric corrosion than ordinary open-hearth steel.	Specifically suitable for railway car construction and for all purposes where high strength, resistance to abrasion, and resistance to all types of corrosion such as would be met with in railway service are required.
Acid-, Oil- and Water-resistant Paper	**Koroseal-coated Paper**	A paper coated with a thin layer of Koroseal, a rubber-like substance impervious to deteriorating fluids and gases. The coated paper is resistant to acid, oil, water, air, and light.	Offers protection for exposed surfaces of machinery while in ocean transit, since coverings can be made from it which will exclude the salt sea air.
Free-cutting Steel	**Ledloy**	A steel in which lead is uniformly distributed throughout in such a fine state of dispersion that it cannot be seen under a microscope. In this form it has no effect on the physical properties of the steel, but makes it much more free-cutting. Ledloy 1120, for example, is said to machine from 30 to 60 per cent more easily than standard S A E 1120. Lead is added in amounts of 0.15 to 0.30 per cent.	Important savings can be effected in the machining time of a large variety of parts such as gears, crankshafts, spindles, spline shafts, etc. The steel is available in all hot-rolled forms, and is also cold-finished by leading producers of cold-drawn steel.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Bonded Stainless Steel	**Ludlite**	A composite product consisting of an outer surface of thin stainless steel permanently bonded to a backing of tough, flexible, non-metallic material. The backing material makes it possible to cement Ludlite to plaster, wood, fiber board, and concrete. Produced in rolls 2 feet wide, and in lengths from 50 to 100 feet, as well as in tiles 4 inches square.	Suitable for lining bins and boxes, for insulating refrigerators, for trimming and covering automobile running boards, etc.; also applicable in the construction of stainless-steel sinks, shelves, and drain-boards in kitchens, and for decorative purposes in the home.
Cellulose Plastic Coating	**Macoid**	A plastic coating for metal, wood, and rubber, applied by dipping; available in bright colors, pastel shades, "metal tones," and other effects, obtained by pigmenting the coating material. A similar material known as "Cellucraft" is applied by spray guns.	Applicable to the finishing of automobile hardware, such as window regulators, door handles, and control knobs; die-castings in general; and molded rubber steering wheels.
Alloy Steel	**Mayari R**	Low-alloy structural steel developed with a view to combining strength, good hot- and cold-working properties, good welding characteristics, little tendency to harden on rapid cooling, and high resistance to atmospheric corrosion. Has a minimum tensile strength of 65,000 pounds per square inch, and a minimum yield point of 50,000 pounds per square inch. Is about six times as corrosion-resistant as ordinary structural steel. Contains small percentages of chromium, nickel, and copper.	Suitable for any purpose where ordinary structural steel is employed, but where the increased strength, better welding characteristics, and higher resistance to corrosion are especially desirable.
Free-machining Monel Metal	**R-Monel**	A grade of Monel metal sufficiently free-cutting to permit machining at high production speeds in automatic screw machines. The easy machining properties are obtained by the addition of a small quantity of sulphur. Tensile strength of cold-drawn rods and bars up to 3 inches in diameter ranges from 80,000 to 115,000 pounds per square inch, with a yield strength of 50,000 to 90,000 pounds per square inch. Hot-rolled rods of similar sizes have a tensile strength of 75,000 to 85,000 pounds per square inch and a yield strength of 35,000 to 60,000 pounds per square inch.	Especially suitable for screws, bolts, and similar machine parts. It is not recommended for parts subjected to more than a moderate amount of cold upsetting and is not intended for hot-working. Produced in three different grades developed for different sizes of work and for varying machining speeds.
Rubber Lining for Tanks	**Multi-Ply**	Liquid rubber which is applied in laminations to the sides of metal tanks to be coated until the desired thickness is obtained. These several coats coalesce during the vulcanizing process into a single sheet, bonded or almost "welded" to the walls of the tank.	Especially applicable to plating and chemical tanks. Provides a continuous, seamless, lap-free, and unbroken lining.
Nickel-chromium Steel	**Nikrome M**	An alloy steel containing from 2 to 2.5 per cent nickel; from 0.90 to 1 per cent chromium; and from 0.40 to 0.50 per cent molybdenum. Minimum guaranteed properties: Tensile strength, 110,000 pounds per square inch; yield point, 90,000 pounds per square inch; elongation in 2 inches, 16 per cent; reduction of area, 47 per cent.	Especially intended for heavy-duty parts, such as axles, shafts, bolts, studs, etc., made to large dimensions—approximately 5 to 8 inches in diameter. The material can be so heat-treated as to be practically uniform in hardness from surface to center.
Brazing Alloy	**Phos-Copper**	A brazing alloy that melts at approximately 1300 degrees F. Possesses high tensile strength and excellent penetration, is self-fluxing for most applications, has high ductility, high resistance to fatigue and corrosion, high electrical conductivity, and unusual fluidity at the brazing temperature.	Suitable for use in place of expensive silver solders; particularly useful for applications where strength or gas- and liquid-tight joints are required. Used on refrigerator parts where leakproof joints are essential.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Calking and Joint-tightening Material	**Plasticalk**	A plastic compound taking the place of putty and similar substances, which does not dry, harden, crack, or shrink with age, but retains its plasticity and adhesiveness indefinitely. It is unaffected by water and humidity and adheres strongly to the substances that it joins.	Used for cementing glass to glass, metal, or wood; for calking crevices; and for making joints of various kinds. Especially useful in the marine field, for refrigerator show-cases, etc.
Metal Finishes	**Prismlac**	A lacquer for obtaining unusual finishes, used either clear on polished metal surfaces or in combination with colors or bronze powders.	The unusual finish is obtained by spraying the surface with a coat of colored lacquer enamel, followed by a coat of Prismlac, which becomes ornamented with crystals, when drying, that will cover the entire surface.
Protection for Finished Surfaces	**Protex**	A liquid that is brushed or sprayed on surfaces to be protected, which are then covered preferably with so-called "Kraft" paper. Sets quickly to a moisture-proof, tough skin, which is a good insulator for low-voltage current. When the covering is no longer needed, it can be readily peeled off with the Kraft paper, or, if paper is not used, it can easily be pulled off by itself. Metal thus protected can be stamped or pierced without removing the coating.	Applied to highly polished, painted, plated, or duco-finished surfaces to protect them from scratches, tarnish, etc.; also sprayed or brushed on parts or assembled machines in storage to prevent rust or corrosion; also used as a coating for equipment in a plant that is not to be used for some time.
Flexible Tubing	**Resistoflex**	Tubing made in sizes up to and including 1/2 inch inside diameter, from a flexible synthetic resin, insoluble in gasoline, oil, ether, and alcohol. Has extreme lightness (weight about one-half that of aluminum), great toughness and strength, good elasticity, and a high degree of flexibility.	Used chiefly in fuel and brake lines; in lubrication systems for automotive equipment, Diesel engines, and aircraft; in chemical and process industries for conveying solvents and oils; in hydraulic lines; and in fuel and oil handling equipment.
Steel for High-temperature Service	**Sicromo**	A corrosion-resistant steel for high-temperature service having at 85 degrees F. an ultimate tensile strength of 74,000 pounds per square inch with a yield point of 40,000 pounds per square inch; at 750 degrees F., 62,000 and 26,500 pounds, respectively; at 1100 degrees F., 36,500 pounds and 20,000 pounds, respectively; and at 1400 degrees F., 13,000 pounds and 7500 pounds per square inch, respectively.	Suitable for applications where corrosion resistance is of major consideration, but where conditions do not warrant the use of the higher-priced 4 to 6 per cent chromium-molybdenum steels. Especially intended for cracking-furnace tubes, vapor and hot oil lines, superheater tubes, etc.
Free-machining Steel	**Speed Treat X-1535**	An open-hearth steel with a carbon content of 0.30 to 0.40 per cent, which can be machined at a surface speed of 150 feet a minute; tensile strength, 95,000 pounds per square inch; ductile enough to be bent flat on itself in the cold-drawn condition without fracture.	Used for parts where free-machining qualities are desirable, in conjunction with high strength.
Free-machining High-strength Steel	**Speed Treat X-1545**	Steel similar to Speed Treat X-1535, except that it has a carbon content of 0.40 to 0.50 per cent, and a tensile strength of 110,000 pounds per square inch. It can be machined at almost the same cutting speed as S A E 1112 Bessemer screw stock.	Used for parts where free-machining qualities are desirable, in conjunction with high strength.
Oxidation-resisting Steel	**Stayblade Max**	Will resist oxidation in air and steam up to temperatures as high as 1650 degrees F. Said to be easily machineable. Contains high percentages of chromium and nickel, as well as titanium and aluminum.	Intended for boiler drums, turbine casings, high-temperature reaction vessels, and other equipment operating at high temperatures and under great stress. Also used for blades in high-temperature turbines.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Protective Rubber Paint	**Surfaseal**	A rubber paint that offers an effectual protective coating on metal and withstands an unusual amount of abrasion.	Can be applied to any metal surfaces. For best results, the surface is sand-blasted and a Surfaseal primer is applied. When the primer has dried, Surfaseal No. 2 is brushed on. To withstand severe abrasion, several coats may be applied twenty-four hours apart.
Cast Steel	**Telastic Moly**	A manganese-molybdenum alloy steel containing from 0.15 to 0.20 per cent molybdenum. Gears 16 feet in diameter weighing 53,000 pounds each, as cast, show when annealed, normalized, and drawn, a tensile strength of 80,000 pounds per square inch, a yield point of 45,000 pounds per square inch, an elongation in 2 inches of 23 per cent, a reduction in area of 40 per cent, and a Brinell hardness of from 160 to 190.	Suitable for castings where great strength and reliability are required; has been applied to gears for speed reducers of moderate size; for rolling mill drives; and for geared power transmissions involving 1000 horsepower or more.
Colored Sheet Metal	**Tint-Metal**	Metal sheets prefinished in attractive colors that are not marred in manufacturing operations if ordinary care is taken in handling. Subsequent painting, lacquering, enameling, baking or other finishing operations are not required. Available in bright, satin, or striped finish, and in crimped or scored patterns.	Suitable for the manufacture of toys, butttons, advertising novelties, decorative panels, molding, window trim, and other stamped and shaped products.
High-speed Steel	**Van-Lom**	A molybdenum high-speed steel containing from 0.78 to 0.83 per cent carbon, 2 per cent vanadium, 4.1 to 4.4 per cent chromium, and 8.75 to 9.25 per cent molybdenum.	Used for cutting tools. Unusual cutting properties are claimed for this steel, as well as uniformity in heat-treatment.
Alloy Steel	**Worthite**	Tensile strength, 67,000 to 75,000 pounds per square inch; yield point, 30,000 to 35,000 pounds per square inch; elongation in 2 inches, 35 to 45 per cent; reduction in area, 35 to 45 per cent; Brinell hardness, 125 to 150. Resistant to sulphuric acid and to weak muriatic acid, but should not be used for hot sulphuric acid above 50 per cent concentration, nor for halogen acids, except very weak solutions.	A high-nickel, high-chromium molybdenum alloy steel suitable for all purposes where chromium-iron alloys or nickel-chromium stainless steels are applicable, and, in addition, for purposes where its ability to resist sulphuric acid is of especial value.
Wear-resistant Alloy	**Xaloy**	Very hard wear-resistant alloy that has been used for some time in oil-well equipment under the trade name "I.R. Metal," but which is now available for broader industrial applications; hardness, 700 to 750 Brinell.	Suitable for coating drill and reamer bushings, deep drawing dies, sizing dies, work-rests, ring and plug gages, pilot bars, and valves.
Galvanized Iron and Steel Sheets	**Zincgrip**	Galvanized iron and steel sheets with a heavy coating of commercially pure zinc that will not crack or peel during drawing or forming operations. Has from 50 to 75 per cent more protective zinc than the "Tight Coat" sheets generally used in making fabricated products.	Suitable for shapes and stampings made by cold-drawing and rolling processes. Refrigerator water-shed pans have been successfully drawn to a depth of 5 inches with the zinc coating intact. Also suitable for spiral corrugated lock-seam drainage pipe and roof drainage parts.
Laboratory Combustion Tubes	**Zircofrax**	Tubes, combustion "boats," and covers, made from zirconium silicate, for use in steel and alloy manufacturing plant laboratories. The "boats" and covers will withstand temperatures up to 2820 degrees F., and the gas-tight tubes over 2900 degrees F.	Applicable for laboratory equipment at temperatures well above those required in the analysis of steels and alloys with high melting temperature.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Stop with Safety Catch for Controlling Rotation of Shaft

By JOSEPH WAITKUS

A machine developed recently for a special process is equipped with a device for feeding certain ingredients. This feeding device is controlled by a mechanism designed to proportion the amount or quantity of the ingredient fed, one complete revolution of the mechanism serving to feed the correct amount. If the supply of the ingredient has been exhausted or there is an insufficient quantity available in the bin, the mechanism will cease to function.

The feeding device (not shown) is attached to shaft *A*, Fig. 1. It is permitted to make one revolution only at a time. When the mechanism is once released for rotation, however, an arrangement is provided whereby the system is held open for operation at any time, regardless of whether or not it is prepared for rotation.

Segment *B* of the device is fastened to shaft *A*. The segment is provided with two pins *C* and *D*. The arm *E* is located between the pins and is attached to segment *B* by means of a small coil spring *F*. Spring *F* is arranged to force arm *E* against pin *C*. The release rod *G* slides vertically in the bearing *H*. The direction in which segment *B* rotates is indicated by the arrow.

The positions of the elements when the device is rotating are shown in Fig. 1. It will be noted that arm *E* rests against pin *C* under the action of spring *F*. Releasing rod *G* is in position to come in contact with arm *E* as rotation continues. When the device is stationary, the elements are positioned as shown in Fig. 2, with arm *E* resting against pin *D*. In this case, arm *E* is forced away from pin *C* by the action of rod *G*, combined with the tendency of segment *B* to continue rotation.

Fig. 3 shows the positions of the various elements at the moment when release rod *G* is raised and the device is free to rotate. It will be noted that arm *E* has moved away from pin *D* under the action of spring *F* and is now resting against pin *C*. Any attempt to stop the rotation is now prevented by arm *E*, which is located under releasing rod *G*. Thus rotation of segment *B* and arm *E* will be cer-

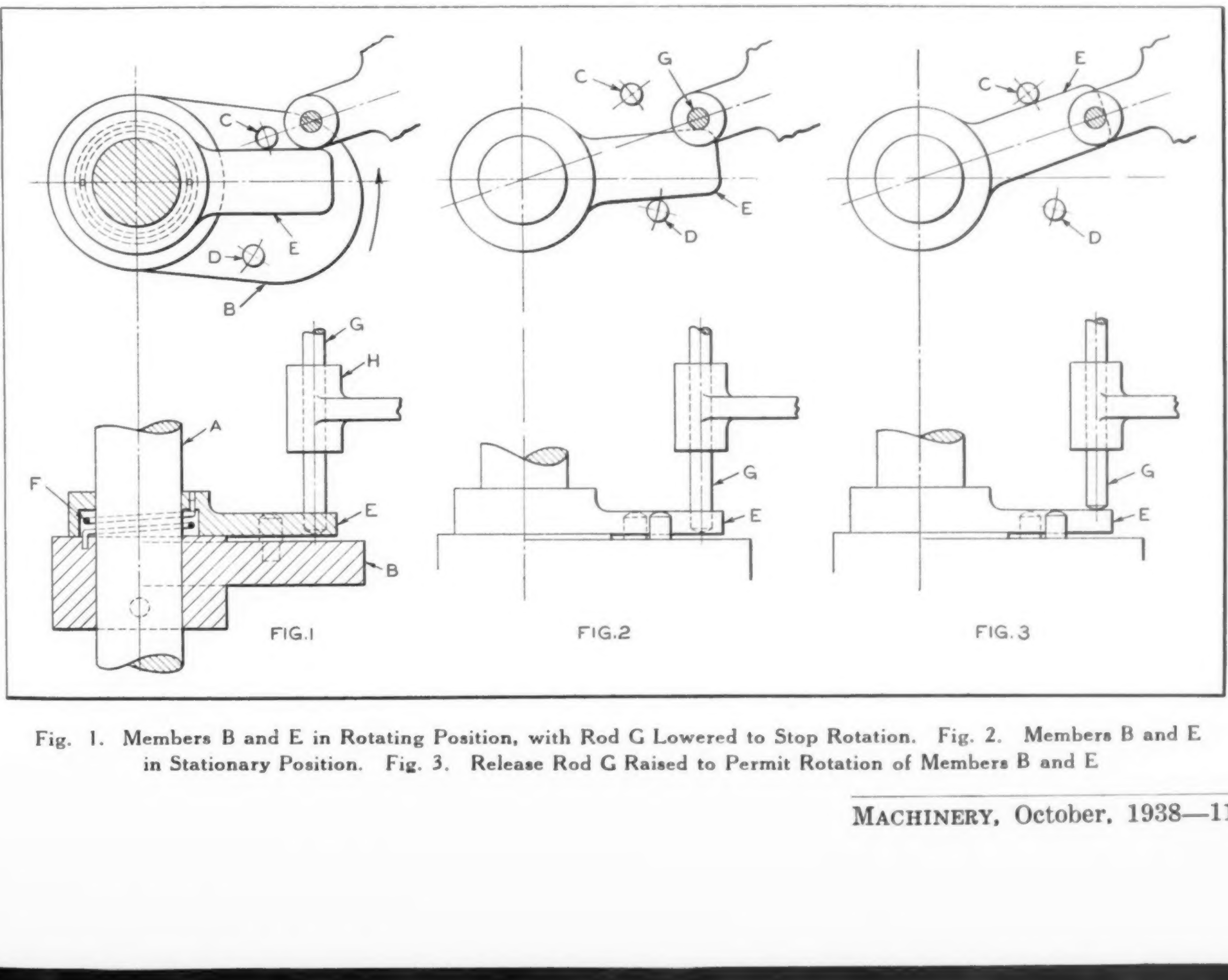


Fig. 1. Members B and E in Rotating Position, with Rod G Lowered to Stop Rotation. Fig. 2. Members B and E in Stationary Position. Fig. 3. Release Rod G Raised to Permit Rotation of Members B and E

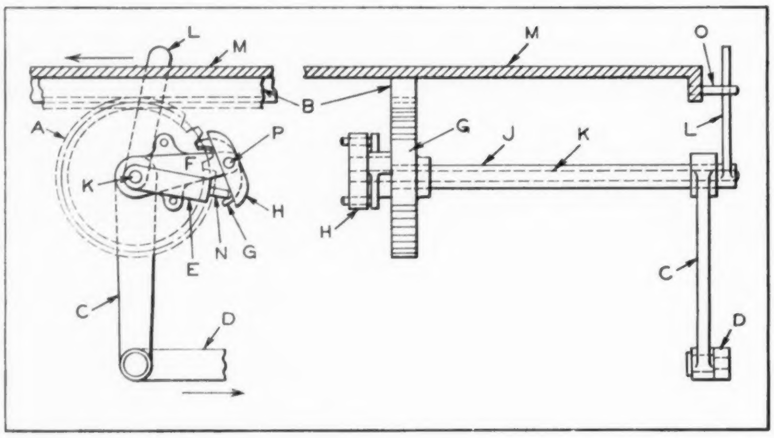


Diagram Showing Arrangement of Reversing Ratchet Movement Controlled by Lever L

tain to take place as soon as shaft A begins to rotate. The operator cannot stop the rotation or prevent its taking place unless he interferes with the action of arm E.

The operator can tell at a glance whether or not any of the ingredient has been fed into the machine by noting the position of the elements of the device. For instance, if they are set in the positions indicated in Fig. 2, he knows immediately that rotation took place after he raised rod G because the device is now locked. If the device is as shown in Fig. 3, he is certain that rotation has not taken place and that no ingredient has been fed into the machine.

Ratchet Movement with Remote Control

By L. KASPER

A reversing ratchet movement in which the operating pawl is tripped from a distant point is shown in the accompanying diagram. This movement is used to control the work-table of a metal polishing machine. Referring to the illustration, M is the work-table carrying the rack B which meshes with gear A. Gear A is free to turn on shaft J, which is supported on bearings (not shown). Shaft J carries the levers F and C at opposite ends, both levers being keyed to the shaft. Rod D transmits an oscillating motion to lever C.

Lever F carries pawl G and bar H, both of which are keyed to shaft P which passes through lever F. Shaft P is a free turning fit in lever F. Shaft K passes through shaft J carrying levers E and L at opposite ends. Lever E carries a plunger N, backed by a spring, which makes contact with bar H, thus engaging pawl G with the teeth of gear A.

Referring to the view at the left, rod D is assumed to be moving in the direction indicated by the arrow, the motion being transmitted through levers C and F, pawl G, and gear A to rack B, so that table M moves in the direction shown by the arrow. As lever E rests against the pin in lever F, motion is transmitted to lever L througn shaft K. On the return stroke of rod D, gear A remains stationary, the pawl G riding back over the teeth.

As the movement of table M continues, pin O eventually strikes lever L, giving shaft K a partial revolution within shaft J, so that lever E is brought against the upper pin on lever F. This causes plunger N to act on the opposite end of bar H, swinging pawl G so that its lower end engages gear A. In this manner, gear A is given a partial revolution on the forward stroke of rod D instead of on the pulling stroke as shown, so that the motion of table M is in the reverse direction. This continues until a pin at the opposite end of table M strikes lever L, again tripping pawl G and repeating the cycle.

Hydraulic Table Traverse for Bench Milling Machine

Although hydraulic operation of bench type machine tools has not yet been developed to any appreciable extent, the requirements specified for a certain vertical milling machine of this classification appeared to be most easily met by employing a hydraulic drive for traversing the table. The table of this machine was required to travel to a dead stop and then reverse at each end of its traversing movement. The table feed was also required to be adjustable while in operation. It was necessary that the operating mechanism be totally enclosed and of as simple construction as possible. It was also desirable that the main casting and principal parts be easy to machine and assemble. The hydraulic table traverse circuit designed to meet these requirements is shown in the accompanying illustration.

Referring to the illustration, the oil which drives the table passes through the inlet pipe, as shown in the diagram at Y, along a channel in the stop-valve C, and thence through the control valve B and one or the other of the cylinder ports F. The table piston is thus forced toward the opposite end of the cylinder until the movement is arrested by one of the stops G. One of the pilot valves A then comes into operation.

As the pressure in the cylinder builds up, valve A is forced downward, uncovering a small port drilled in the cylinder cover, which allows oil under pressure from the main cylinder to act on the end of the control valve B, as shown in the view at X, thereby forcing it for a short distance toward the opposite end of its chamber. During this movement, the load-and-fire arrangement is brought into action, carrying valve B to its correct position for reversing the table feed. When the table reaches the opposite stop G, the sequence is repeated.

Referring to view *X*, it will be seen that a load-and-fire mechanism is necessary, because control valve *B* can be moved only by oil under pressure from the main cylinder acting on the end until the port *F* is closed, as the supply is then cut off. Further movement of valve *B* under the action of the load-and-fire mechanism connects port *F* to the exhaust port *E*.

Referring again to view *X*, the two port holes are drilled in each cylinder cover leading to the chamber in which control valve *B* operates. The upper hole, when it is uncovered by pilot valve *A*, allows pressure oil from the main cylinder to pass through and operate control valve *B*. The lower hole provides for the escape of oil from the control-valve chamber which would otherwise be trapped and prevent valve *B* from completing its movement. The oil passes to the exhaust exit through pilot valve *A*, which is grooved and drilled as shown in the detail view.

The lower hole in the cylinder cover connects the spring chamber of valve *A* to the exhaust. Any oil that may accumulate is thus allowed to escape freely when valve *A* moves downward. The pinion *D*, which engages teeth cut in valve *B*, provides for hand operation. A control wheel, fitted to the pinion-shaft, is located at the front of the bed casting. The pinion is withdrawn from engagement with the rack when the machine is in normal operation.

The table of the machine, which is 11 inches long by 5 inches wide, has a maximum stroke of 4 inches. With the circuit described, employing an oil pressure of 100 pounds per square inch, the feed rate can be varied from 0 to 20 inches per minute. The diameter of the piston and piston-rod are 1 5/8 inches and 5/16 inch, respectively. The control valve *B* is 3/4 inch in diameter, and the pilot valve *A*, 7/16 inch.

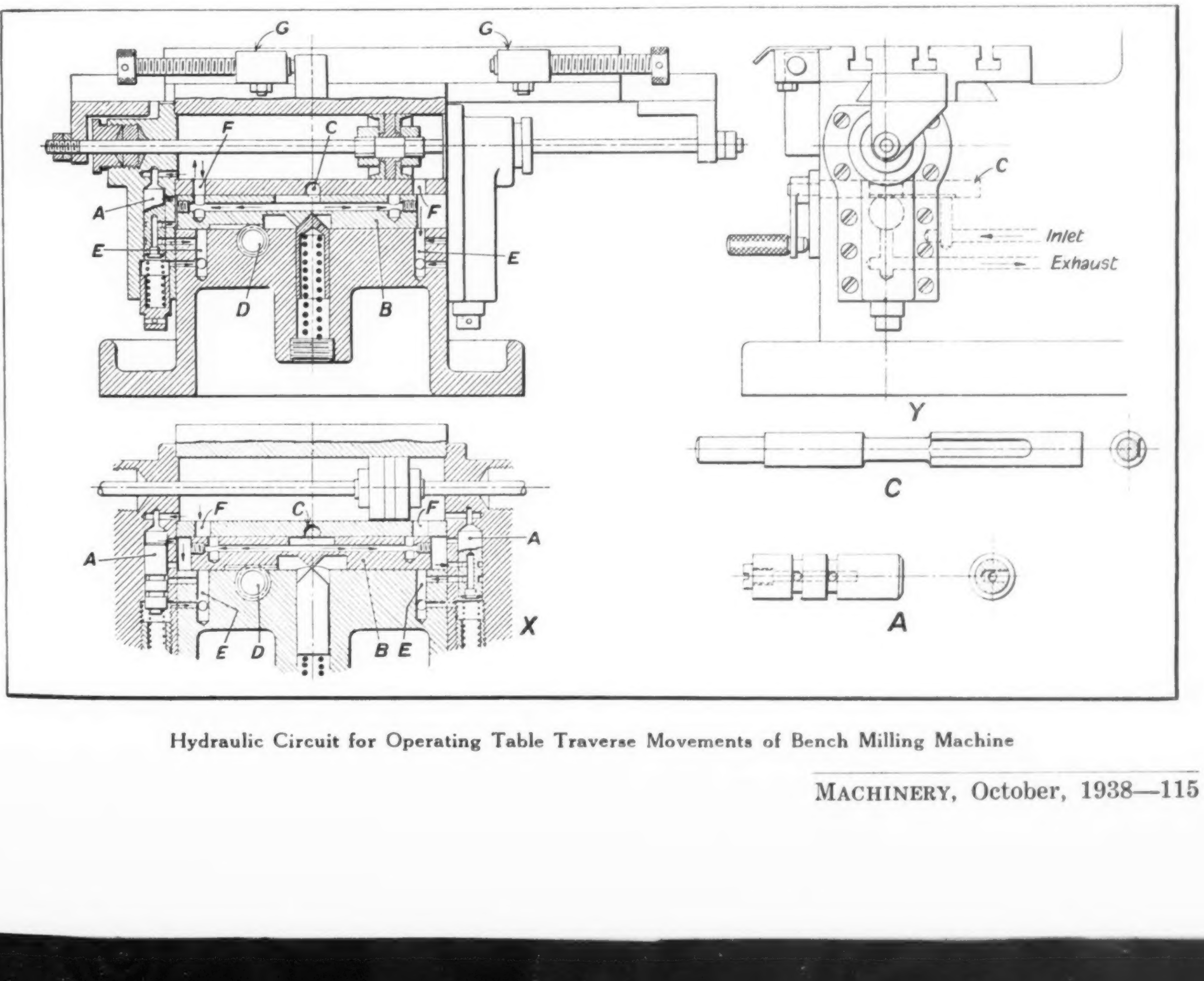
Oil is supplied by a gear pump which provides a constant pressure with variable output, and which is adjustable while in operation. The rotational speed is fixed to suit the pressure required, no release valve being necessary.

* * *

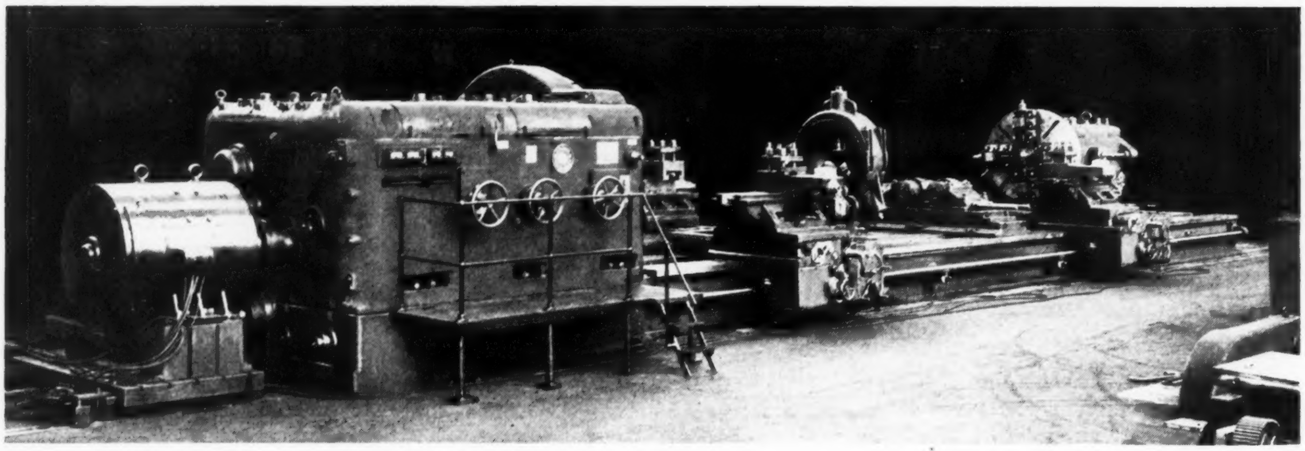
Semi-Annual Meeting of Tool Engineers in Pittsburgh

The American Society of Tool Engineers, 2567 W. Grand Blvd., Detroit, Mich., will hold its semi-annual meeting October 14 and 15 in the William Penn Hotel, Pittsburgh, Pa. The first day will be devoted to plant visits to the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co.; the Homestead Works of the United States Steel Corporation; the New Kensington Works of the Aluminum Company of America; the Mesta Machine Co., Homestead, Pa.; the Firth-Sterling Steel Co., McKeesport, Pa.; and the Mellon Institute, Pittsburgh, Pa.

At a dinner to be held Friday evening, October 14, J. H. Van Deventer, editor of *The Iron Age*, will speak on "Tools, Taxes and Wages." Later in the evening, the semi-annual meeting and a technical session will be held. Saturday morning there will be a technical session, at which L. W. Chubb of the Westinghouse Electric & Mfg. Co. will speak on "Industrial Advancement through Scientific Research."



Hydraulic Circuit for Operating Table Traverse Movements of Bench Milling Machine



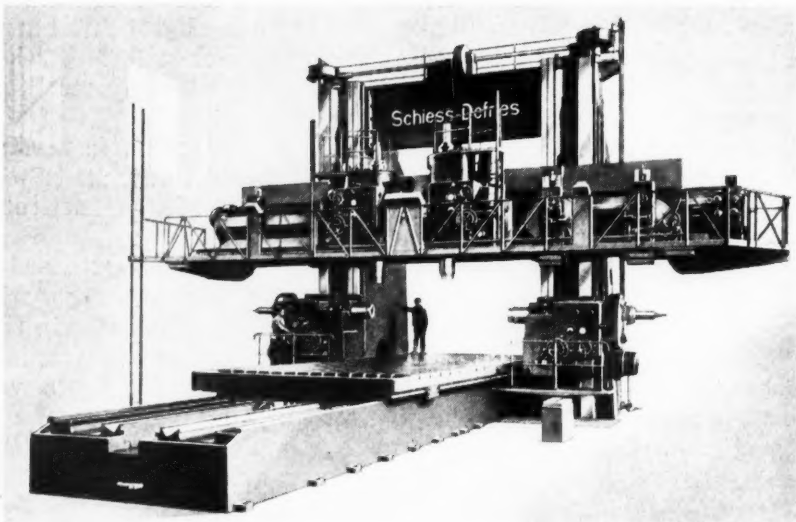
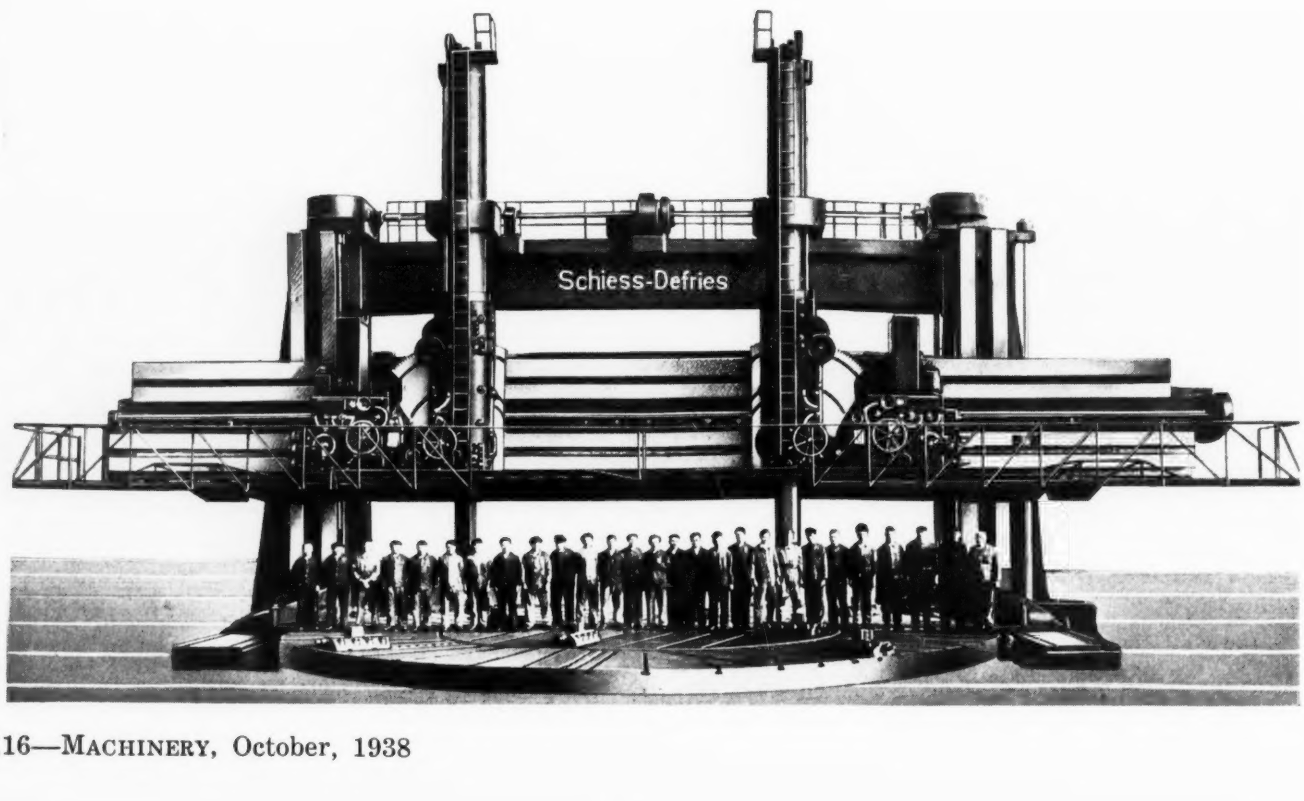


Fig. 1. (Above) A Schiess-Defries Lathe Taking Work 8 Feet in Diameter and Having a Bed Over 60 Feet Long

Fig. 2. (Left) Combination Milling Machine and Planer Having a Bed Over 70 Feet Long and Clearance for Work 16 by 16 Feet

Fig. 3. (Below) A Boring Mill Weighing 860 Tons on which Work Over 73 Feet in Diameter can be Turned



Some Huge German Machine Tools

THE firm of Schiess-Defries A.G., Düsseldorf, one of the oldest machine tool builders in Germany, specializes in the building of almost all types of exceptionally large machine tools—lathes, planers, horizontal boring machines, vertical boring mills, and gear-cutting machines. The accompanying illustrations show a few of the very large machines that have been built by this company. Equipment of this kind finds application especially in the building of hydraulic turbines, electric generators, Diesel engines, equipment for the chemical industries, and similar requirements.

Fig. 1 shows a lathe that will take work up to 8 feet in diameter. The length of the bed is approximately 62 feet. Work weighing up to 150 tons has been turned in this lathe. Fig. 2 shows the largest combination planer and milling machine ever built by this company, which is believed to be the largest sized planer ever built in the world. This machine weighs 350 tons. The length of the bed is 72 feet. The clear space for the work between the uprights and beneath the cross-rail is over 16 by 16 feet. It is arranged for milling longitudinally and transversely, boring, and planing heavy work in one setting. Fig. 3 shows a mammoth vertical boring and turning mill. This machine weighs 860 tons and is designed to handle work up to 400 tons in weight. With the uprights in the normal position, it will turn work 59 feet in diameter. Provision is made for moving the uprights back of the center of the rotating table, thereby permitting work up to 73 feet 9 inches in diameter to be turned. The maximum turning height is about 16 feet 5 inches.

Fig. 4. A Schiess-Defries Gear-hobbing Machine Capable of Cutting Gears up to 23 Feet in Diameter

Fig. 4 shows a gear-hobbing machine of unusual size designed for cutting spur, helical, herringbone, and worm gears up to 23 feet in diameter. Fig. 5 shows a horizontal boring and milling machine having a boring spindle 12 inches in diameter, within which is mounted a central high-speed spindle. The total height of this machine is over 30 feet. Figs. 6 and 7 show two illustrations of a vertical plate-bending press for bending plates up to 20 feet in width and up to a thickness of 2 1/2 inches. This

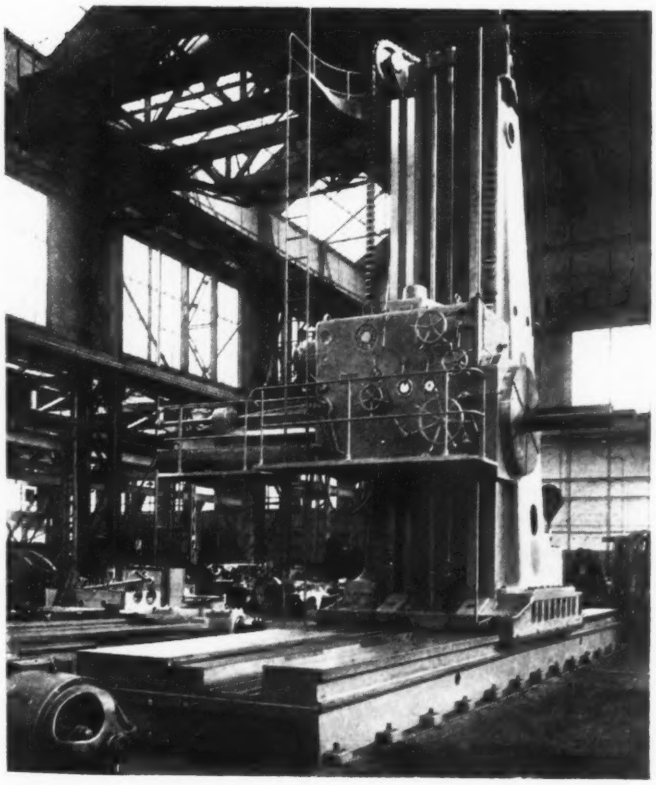


Fig. 5. Horizontal Boring and Milling Machine with a 12-inch Spindle, Having a Total Height of Over 30 Feet

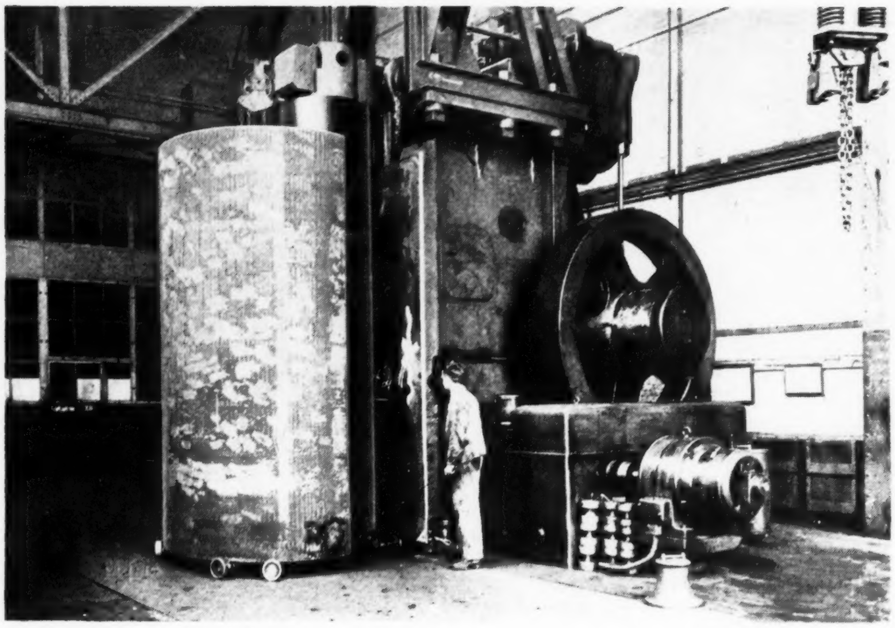
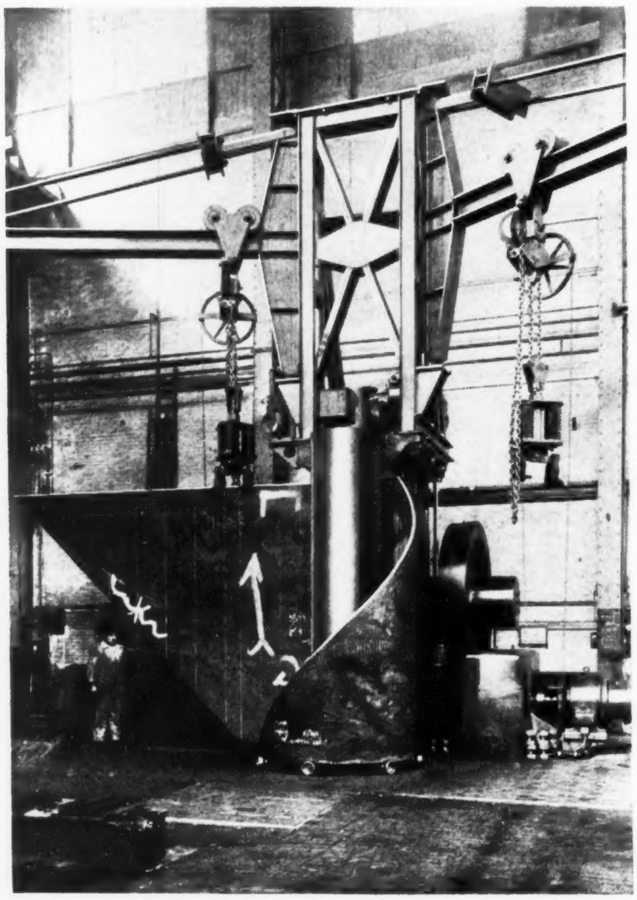


Fig. 6. A Schiess-Defries Plate-bending Machine in the Plant of Sulzer Bros., Winterthur, Switzerland, Bending a Plate 2 1/2 Inches Thick

machine is in operation at the Sulzer Bros. plant, Winterthur, Switzerland, where the photographs were taken.

The building of very large machine tools as a "standard" product is possibly more generally practiced in Germany than in this country. The large sizes of machine tools exhibited at the Leipzig Fair might be taken as an indication of this. Some huge machines are shown there every year.



Williams "Supersocket" Wrench Set Correction

In September MACHINERY, page 61, in the last paragraph of the article entitled "Williams Torque 'Measurrench' and 'Supersocket' Wrench Set," it is erroneously stated, due to a typographical error, that the Supersocket wrench set includes bits for handling 1 1/4- to 1 3/8-inch hollow hexagonal socket set-screws and hollow cap-screws. The sentence should have read: "The AL-101 set contains nineteen pieces, including ten bits for handling from 1/4- to 1 3/8-inch hollow hexagonal socket set-screws and hollow cap-screws in sizes from No. 8 to 1 inch."

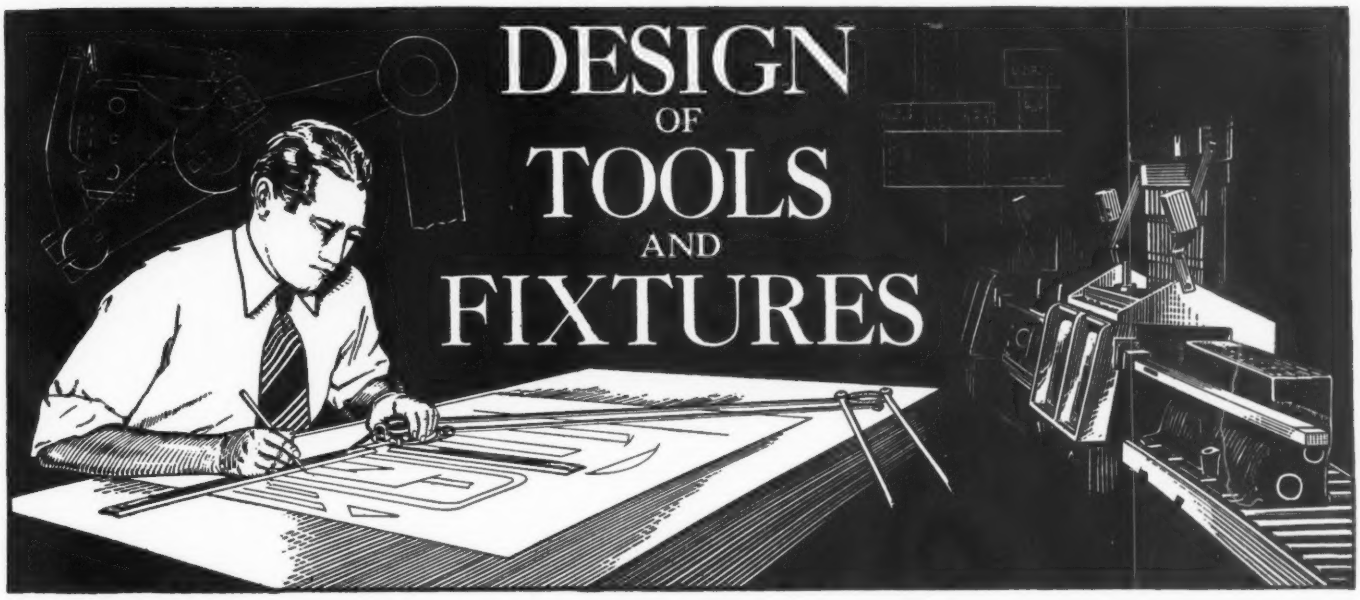
* * *

Exposition of Power and Mechanical Engineering

Over 250 exhibitors have already engaged space for the Thirteenth National Exposition of Power and Mechanical Engineering, to be held in the Grand Central Palace, New York City, during the week of December 5 to 10. The Exposition will occupy three floors. Basing the estimate upon the attendance of past expositions, the management expects that the show will be visited by some 40,000 people interested in the power and mechanical engineering industries.

Among the exhibits of especial interest to the machine shop engineer and executive will be belt transmissions of various types, chain drives, flexible couplings, speed reducers, bearings, oil filters, and various types of machine tools.

Fig. 7. Another View of the Plate-bending Machine, Bending a Boiler Shell with a Helical Seam

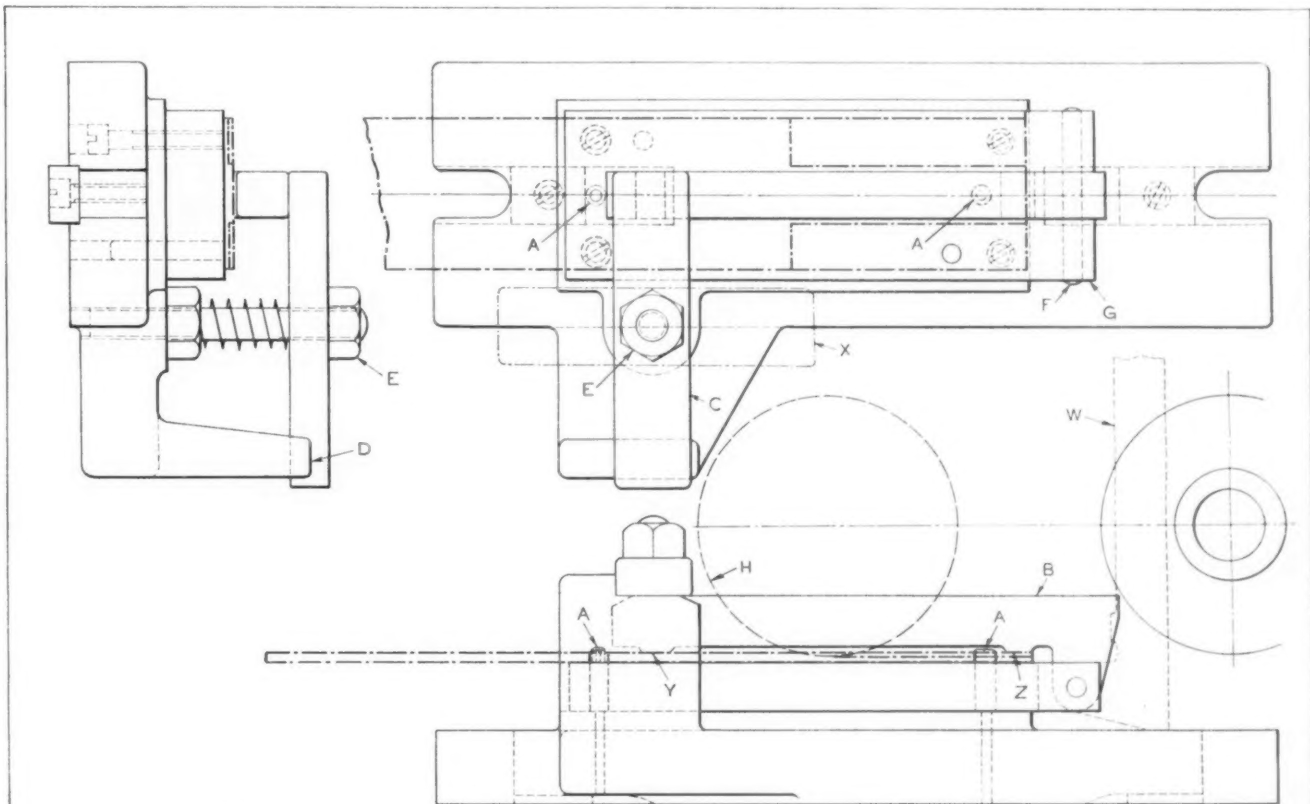


Milling Fixture Designed to Insure Safe Operation

By C. COLE, Dayton, Ohio

The milling fixture shown in the accompanying illustration was designed to permit the work shown in heavy dot-and-dash lines to be clamped in place without bringing the hands dangerously near the revolving cutters. The piece to be milled, consisting of a steel strip 1/8 inch thick by 2 inches wide by 10 1/8 inches long, is placed over the two locating pins *A*, the clamps *B* and *C* being in the positions shown by the dotted lines at *W* and *X*. Clamp *B*, which is made long enough to avoid any necessity for bringing the hand near the cutters, is then swung down into the clamping position. The clamp *C* is next turned 90 degrees to the right against stop *D*. The nut *E* is now drawn tight to complete the work-clamping operation.

To prevent the boss *Y* on clamp *B* from exerting more than its share of the clamping pressure in



Milling Fixture which can be Operated without Placing Hands Near Cutters

case of variations in the thickness of the stock, more metal is ground off boss Y than off the boss Z. This allows clamp B to be sprung against the work at Y after boss Z has been pressed against the work. Clamp B is made of tool steel and is hardened to give it the necessary springiness.

The pin F is pressed into clamp B and is a running fit in the hardened plate G. This arrangement serves to eliminate side play in clamp B. Two spiral milling cutters are used with a spacing collar 0.750 inch wide between them. The extreme cutting position of the milling cutters is shown at H.

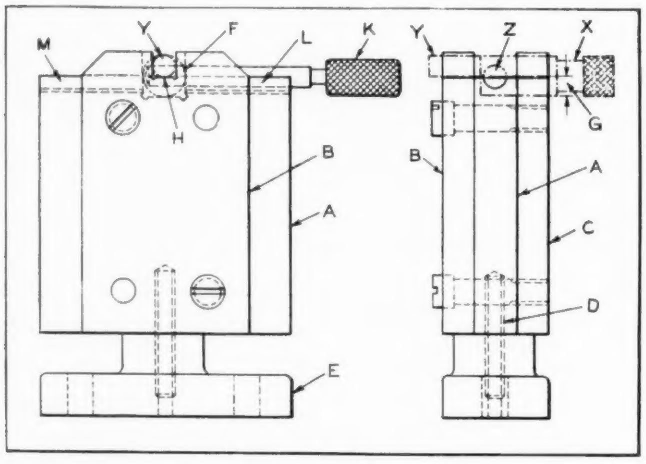
Gage for Checking Hole Location

A unique yet simple gage for checking the location of a crosswise hole with respect to an eccentric pin machined on the end of a stud is shown in the accompanying illustration. The gage is composed primarily of three sections A, B, and C, held together in one compact block by two screws and two dowels. In the lower end of section A is a threaded stud D for fastening the gage to the base E, which is secured to the work-bench with screws. By having the gage attached to the bench, both of the inspector's hands are left free, so that he can hold the work X in place with one hand while holding the test plug K in the other hand.

The work, indicated by heavy dot-and-dash lines at X, has an eccentric end or pin Y and a crosswise hole Z at right angles to the eccentric. The diameter of the large portion F of the stud fits into the notch in plate C, while the diameter of the pin or end Y fits the notch in the plate B. This arrangement locates the stud radially from the eccentric; the distance from the center of the hole Z to the bottom of the groove is maintained as indicated by the dimension G, there being a clearance at H for the eccentric.

With the gaging pin K resting in the V-groove at L in the manner shown, it will enter the hole Z in the work, provided the hole is in the proper location relative to the center line, this being the "Go" side of the gage. However, the gaging pin must not enter the hole from the opposite V-groove at M. Thus one V-groove is made to gage the position of the hole above the center, while the other V-groove is made to gage the position below the center. The hole diameter is, of course, previously tested with a "Go" and "Not Go" plug gage.

F. H. M.



Gage for Checking Hole Location Relative to Eccentric

Drill Jig for Circular Segments

By JOSEPH WAITKUS, Wellsville, N. Y.

In fabricating ring segments, it is necessary to drill three holes in each part to provide means for fastening the segments in place to form a continuous ring or circle. The diameter of the circle thus formed is approximately 9 feet. It is essential that each hole be drilled on a radial line extending from the hole to the center of the circle to insure accurate alignment of the bolt holes. The drill jig designed for this purpose has adjustable gaging points, which serve to test the segment for form and size prior to the drilling operation, as well as to locate the work for drilling. The device can therefore be considered a combination jig and gage.

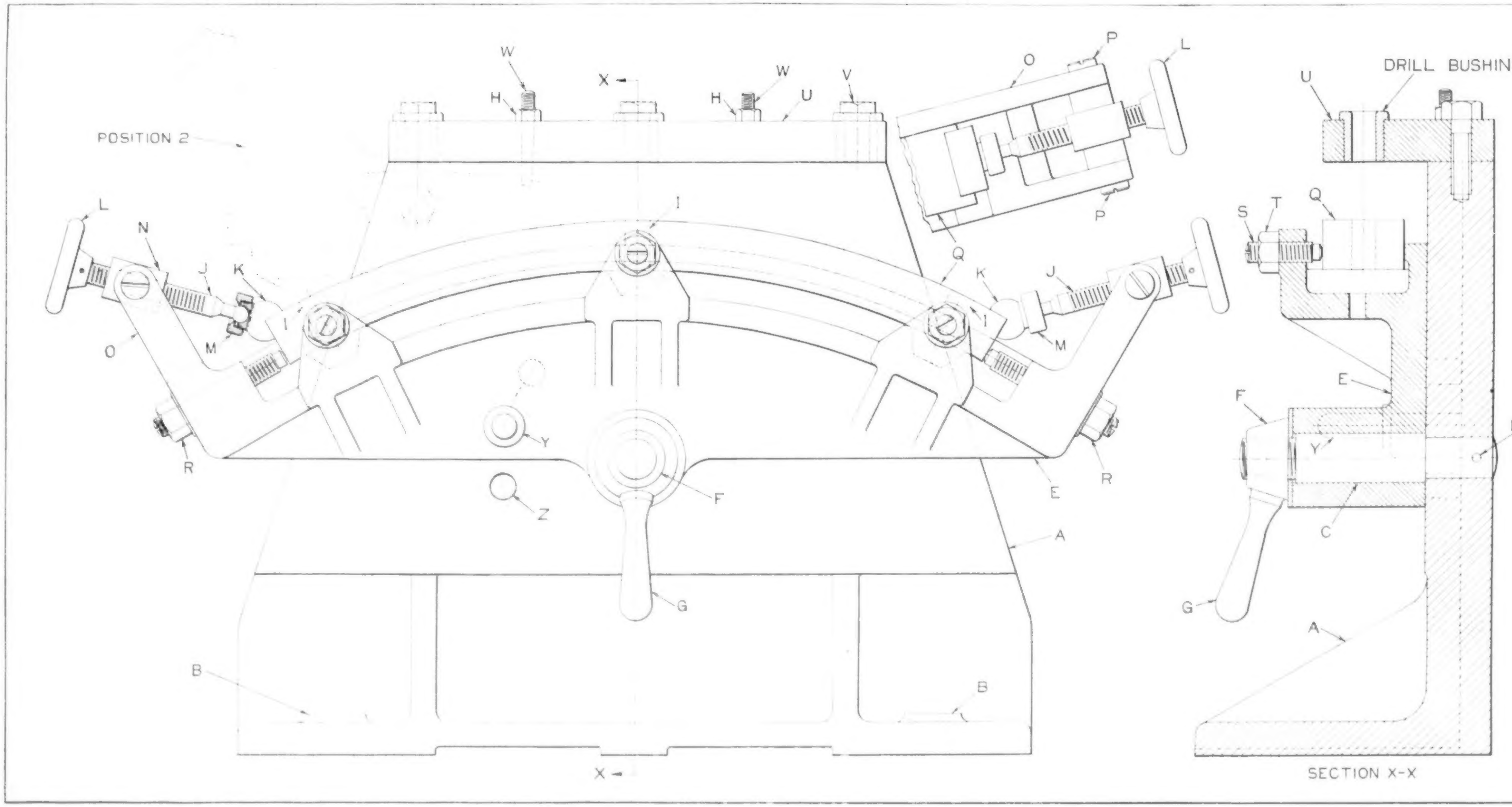
The jig is supported by the plate A having holes through the bosses B for bolting to the bed of the drill press. A trunnion C, pressed into the main plate and held in place by the dowel-pin D, serves to support the indexing carriage E. A nut F, provided with a handle G, is furnished for locking the carriage to the main plate.

The segment Q to be drilled is held in position on the carriage by five adjustable stops and two clamps. Each of the clamps consists of a screw J provided with a jaw K and a handwheel L. A ball joint permits the jaw to rotate freely, so that it can assume any position necessary for obtaining a firm grip on the segment to be drilled. The ball on the end of screw J was machined and fitted to a socket machined in the jaw K, the whole joint being sealed by the cap M.

The trunnion nut N is located between two fingers O which extend from the indexing carriage, and is held in place by two studs P. With this arrangement, the maximum pressure is applied at the corner of the segment in a downward direction toward the center of the segment, so that there can be no movement of the work in any direction.

There are two adjustable stops for the ends of the work. These stops consist of a screw and a locking nut R. The three front stops consist of a screw S and a locking nut T. Adjustment of the stops can be made to suit any variation in the segment. If the segment is twisted or distorted, its condition will be immediately detected through failure to fit properly between the machined surface and the front stops.

The drill bushing plate U is fastened to the top of the main plate by screws V, and is accurately located in position by two dowel-pins W. The dowel-



Jig for Drilling Three Radial Holes in Segment of Ring Having a Diameter of 9 Feet

pins permit the bushing plate to be removed and accurately replaced at any time.

The three holes *I* to be drilled in the segment necessitate indexing the carriage to three different positions. In order to lock the carriage securely in each of the three positions, particularly when drilling the end holes, a pin *Y* is provided which fits into a hole in the indexing carriage and into holes *Z* in the main plate of the jig.

The operation of the jig is based on the principle of rotating the segment to a position where a radial line at the point where the hole is to be drilled, will be in a vertical position. Position No. 2 for drilling one of the end holes is shown by dotted lines. The jig was constructed very rigidly because of the toughness of the material being drilled, which required heavy drilling pressures. Additional drill bushings can be located in the plate *U* to permit drilling more holes in the segment, and extra holes *Z* can be drilled for the indexing pin. Segments of various dimensions can be drilled by adjusting the stops and clamps.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 123 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October Number of MACHINERY.

Electrical Transformers and Welding Machines

EISLER ENGINEERING CO., 756 S. 13th St., Newark, N. J. Catalogue 38-T, illustrating and describing a complete line of distribution transformers, spot welding transformers, and many types of special and standard transformers. The catalogue also shows a complete line of special welding machines with air- and water-cooled transformers, as well as electric welders. 1

Small Tools

PRATT & WHITNEY, DIVISION NILES-BEMENT-POND CO., Hartford, Conn. Catalogue 15, covering the complete line of small tools made by this concern, including milling cutters, punches, dies, drills, reamers, taps and threading tools, etc. Complete data, including prices, are given, and the book is indexed for ready reference. 2

Allegheny Stainless Steels

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Booklet illustrating pictorially the unlimited possibilities of stainless steel for consumer products and industrial applications. Included is a brief summary of Allegheny stainless products carried in stock for immediate shipment. 3

Monel, Nickel, and Nickel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Folder entitled "Joined for Life against Stress and Corrosion," discussing construction with welded Monel, nickel, and Inconel.

Guide to the selection of engineering specifications for gray cast iron. 4

Planetary Milling and Threading

HALL PLANETARY CO., Fox St. and Abbottsford Ave., Philadelphia, Pa. Treatise entitled "Planetary Method of Milling and Threading," illustrating and describing the principles and advantages of this method for stepping up production and saving costs. 5

Electric Welding

LINCOLN ELECTRIC CO., Cleveland, Ohio. Booklet entitled "A Story of Faith that Led to Fortune," describing the growth of a business in which the advantages of electric welding have been recognized and used to the fullest extent in the production of general contractors' equipment. 6

Electric Welding Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Descriptive folder 18-345, on "Weld-O-Trol"—an ignitron alternating-current welding contactor without timing. Booklet entitled "The Welder's Trouble Shooter," listing common troubles met by welders, together with the cause and cure for each. 7

Wood Boring Machines

B. M. ROOT CO., York, Pa. General catalogue 84, covering vertical and horizontal boring machines, drilling heads, and other woodworking machinery. Bulletin 71, illustrating and describing the Root vertical hydraulic-feed multiple universal borer. 8

Interferometers

GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Ave., Chicago, Ill. Bulletin 140, "Interferometers for Expansion Measurements"; also bulletin entitled "The Use of the Interferometer in the Porcelain Enameling Industry." 9

Milling Machines

NATIONAL BROACH & MACHINE CO., Shoemaker and St. Jean Sts., Detroit, Mich. Catalogue entitled "Rotomill," illustrating and describing a new type of milling machine designed for economy and speed of operation. 10

Thread-Grinding Machines

JONES & LAMSON MACHINE CO., Springfield, Vt. Catalogue illustrating and describing the company's automatic thread-grinding machine and attachments. Various forms of threads that can be ground are also shown. 11

Lubricants

TEXAS CO., 135 E. 42nd St., New York City. Booklet entitled "Rock Drills and How to Keep them Functioning Properly," containing information on the proper lubrication of these tools, as well as other maintenance data. 12

Precision Gage-Blocks

FORD MOTOR CO., Johansson Division, 3674 Schaefer Road, Dearborn, Mich. Circular 7010, dealing with the inspection and reconditioning service offered by the company for Johansson gage-blocks and accessories. 13

Gears, Speed Reducers, and Couplings

CHARLES BOND CO., 617 Arch St., Philadelphia, Pa. Stock gear catalogue N-59, covering gears, sprockets, speed reducers, flexible couplings, and other industrial equipment. 14

Small Tools

STANDARD TOOL CO., 6900 Central Ave. S.E., Cleveland, Ohio. General catalogue 38, covering this company's complete line of small tools, including drills, reamers, taps and dies, milling cutters, chucks, etc. 15

Industrial Temperature Gages

WESTON ELECTRICAL INSTRUMENT CORPORATION, Newark, N. J. Circular T11A, containing complete information on a new line of all-metal thermometers, or industrial temperature gages. 16

Hardening Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Folder entitled "Vapocarb Hump Hardening," describing how planned hardening helps to add 60 per cent to the life of tools. 17

Bench Lathes

PRATT & WHITNEY, DIVISION NILES-BEMENT-POND CO., Hartford, Conn. Circular 443, illustrating and describing Pratt & Whitney new bench lathes, made in two sizes, of 7 by 16 and 10 by 20 inches. 18

Pedestal Motor-Drive Lathe

SOUTH BEND LATHE WORKS, 724 E. Madison St., South Bend, Ind. Catalogue 97, illustrating and describing the company's new pedestal motor-drive lathes in five sizes, from 9- to 16-inch swing. 19

Files

GROBET FILE CORPORATION OF AMERICA, 3 Park Place, New York City. Catalogue R-15, on rotary files, illustrating more than two hundred hand-cut, rasp-cut, milled-cut and other types of files. 20

Steel Stamps

NEW METHOD STEEL STAMPS, INC., 149 Jos. Campau St., Detroit, Mich. Bulletin 113-1, containing illustrations, dimensions, and prices of various styles of steel stamps made by the company. 21

Contour Cutting Machines

CONTINENTAL MACHINES, INC., 1301 Washington Ave., S., Minneapolis, Minn. Circular outlining the exclusive features of the new model Doall band-sawing, filing, and polishing machines. 22

Twist Drill Grinders

COVEL MFG. CO., Benton Harbor, Mich. Bulletin 9-38, describing Yankee twist drill grinders with a new attachment for grinding two-, three-, or four-lip twist drills, counterbores, etc. 23

Resurfacing Equipment

IDEAL COMMUTATOR DRESSER CO., 1227 Park Ave., Sycamore, Ill. Circular showing various applications of "Ideal" resurfacers for truing commutators and slip rings in their own bearings. 24

Corrosion-Resistant Coatings

AMERICAN CONCRETE & STEEL PIPE CO., Los Angeles, Calif. Catalogue describing Amercoat, a corrosion-proof sprayable plastic coating for metal, concrete, or wood surfaces. 25

Industrial Lighting

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Catalogue entitled "Handbook of Localized Lighting," covering a line of 700 distinct units available for industrial lighting. 26

Roll-Grinding Machines

NORTON CO., Worcester, Mass. Bulletin 125, illustrating and describing Norton Type D roll-grinding machines, with swings of 20 to 36 inches and traversing work-tables. 27

Electric Welding

THOMSON-GIBB ELECTRIC WELDING CO., 170 Pleasant St., Lynn, Mass. Folder entitled "How to Weld Aluminum, Copper, Stainless Steel, Nickel, and Monel Metal." 28

Milling Machine and Jig Borer

LINLEY BROS. CO., 14 Montauk St., Bridgeport, Conn. Bulletin illustrating and describing a high-speed vertical bench milling machine and jig borer, with or without cabinet base. 29

Wire-Rope Clamp

MARINE SPECIALTY CO., 3178 Bellevue Ave., Detroit, Mich. Bulletin illustrating and describing a new type wire-rope clamp which eliminates the splicing of wire rope. 30

Eye-Shields

JACKSON ELECTRODE HOLDER CO., 15122 Mack Ave., Detroit, Mich. Folder illustrating and describing the different types of eye-shields made by the company. 31

Turret Lathes

INTERNATIONAL MACHIINE TOOL CO., Indianapolis, Ind. Catalogue

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illustrating and describing the Libby Uni-Flex turret lathe for general-purpose use. 32

Microscope Aligning Instrument

CINCINNATI GRINDERS, INC., Cincinnati, Ohio. Circular G-419, descriptive of a microscope aligning instrument for aligning long Cincinnati grinding machine beds. 33

Surface Finishing

MICROMATIC HONE CORPORATION, 7401 Dubois St., Detroit, Mich. Publication entitled "Surface Finish Related to Wear in Internal Combustion Engines." 34

Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin 33-675 on Type U De-Ion air circuit-breakers. 35

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Circular GEA-2954, on reduced-voltage, alternating-current, magnetic starters. 36

Spray Equipment

ECLIPSE AIR BRUSH CO., INC., Newark, N. J. Catalogue entitled "Eclipse Spray Equipment—High Speed at Low Pressure." 37

Ball Bearings

M-R-C BEARINGS SERVICE CO., Jamestown, N. Y. Booklets 2 and 3, entitled "How to Service Ball Bearings in Automotive Equipment." 38

Screws

AMERICAN SCREW CO., Providence, R. I. Bulletin entitled "The Plus-Sign Head that Takes Half the Work Out of Screwdriving." 39

Rebuilt Machinery

BOTWINIK BROS., INC., 67 Water St., New Haven, Conn. Catalogue 191, illustrating and describing rebuilt machine tools. 40

Motors

RELIANCE ELECTRIC & ENGINEERING CO., Ivanhoe Road, Cleveland, Ohio. Bulletin 306, on a new reversing motor drive for planers. 41

Engineering Drafting Symbols

FREDERICK POST CO., Box 803, Chicago, Ill. Chart giving 249 symbols used in engineering and architectural drafting-room work. 42

Quill Bearings

BANTAM BEARINGS CORPORATION, South Bend, Ind. Bulletin 103P, describing Standard Quill bearings and giving engineering data. 43

Thermit Welding

METAL & THERMIT CORPORATION, 120 Broadway, New York City. 34-page booklet completely describing the thermit welding process. 44

Electric Motors

BARBER-COLMAN CO., Rockford, Ill. Data Sheet M-60, illustrating and describing shaded-pole induction motors. 45

Tools

H. K. PORTER, INC., Everett, Mass. Catalogue covering the company's line of hand-operated cutters for industrial and other uses. 46

Anchorage for Bolts and Screws

RAWLPLUG CO., INC., 98 Lafayette St., New York City. Catalogue 38, entitled "A Better Anchorage for Bolts and Screws." 47

Industrial Vacuum Cleaning

CONNECTICUT BLOWER CO., P. O. Box 884, Hartford, Conn. Bulletin 63, on industrial vacuum cleaning systems. 48

Gears

NEW JERSEY GEAR & MACHINE WORKS, 1360 Whitman Ave., Camden, N. J. Catalogue on Spauldite silent gears. 49

Vibration Insulation

B. F. GOODRICH CO., Akron, Ohio. Catalogue section 7900, on "Vibro-Insulators." 50

Steel Belt Plates and Rivets

BRISTOL CO., Waterbury, Conn. Bulletin 729, on steel belt plates and rivets. 50-A

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 125-143 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 125-143 — or write directly to the manufacturer, mentioning machine as described in October MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	

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[SEE OTHER SIDE]

Shop Equipment News

Fig. 1. Landis "Race-A-Way" Grinder, Developed for Grinding Internal and External Raceways of Ball-bearing Races

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Landis "Race-A-Way" Grinding Machine

The No. 2 "Race-A-Way" grinder developed recently by the Landis Tool Co., Waynesboro, Pa., for grinding ball-bearing raceways is unlike any machine of its general type previously brought out, from the standpoint of operation, design, and appearance. It can be furnished with equipment for grinding the inner raceways of outer races or it can be had with equipment for grinding the external raceways of inner races. When equipped for internal grinding, the machine has a capacity for handling the smaller races up to and including the 212, 311, and 409 groups. External raceways of races in sizes up to and including the 218, 316, and 414 groups can be handled. The machine can be used for grinding the races of both single- and double-row bearings.

The entire grinding cycle is automatic. The operator simply loads the work into the machine and depresses the cycle-starting button. The race is then completely ground to size automatically, all the machine movements being stopped without further attention. Thus, one man can easily operate two machines.

At the end of the grinding cut, that is, during the "sparking out," when the work is practically to size, both the feeding-in movement and the work-head oscillations stop with the work-head centered. The wheel then sparks out without any oscillating motion whatever. This produces a raceway with a superior finish which requires no further form-grinding operations in order to secure the degree of finish required for bearings of the precision types.

The movements of the machine are controlled by electric push-buttons and selector switches, although certain hydraulic movements are also employed. The cycle controls permit the operator to use any portion of the cycle separately. Every machine movement can be stopped instantly by a master safety button. The hydraulic wheel resetting mechanism is an important time-saving feature which causes the wheel-base to be reset automatically at the end of each grinding cycle. The amount of the reset is adjustable and is equal to the amount of stock removed from each race. Basically, the machine is the same whether equipped for internal or external grinding. The main difference is in the design of the sizing device and work-holding chuck and in the size of the grinding-wheel spindle and wheel.

Automatic sizing is accomplished by means of the Landis-Solex sizing device in combination with an electric timing arrangement. The oscillating movement of the work-head is obtained through an adjustable crank. A worm-gear speed reduction provides four oscillating speeds. The motor that drives the work is mounted on the lower end of the oscillating column, a V-belt driving the work-spindle directly from the motor. Adjustable-pitch pulleys give a wide work speed ratio. Provision is made for moving the work-head

To obtain additional information on equipment described on this page, see lower part of page 124.

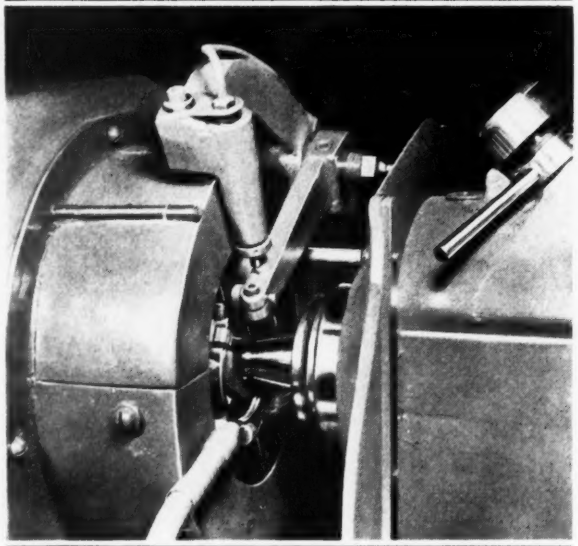


Fig. 2. Typical Internal Grinding Set-up on the Machine Shown in Fig. 1

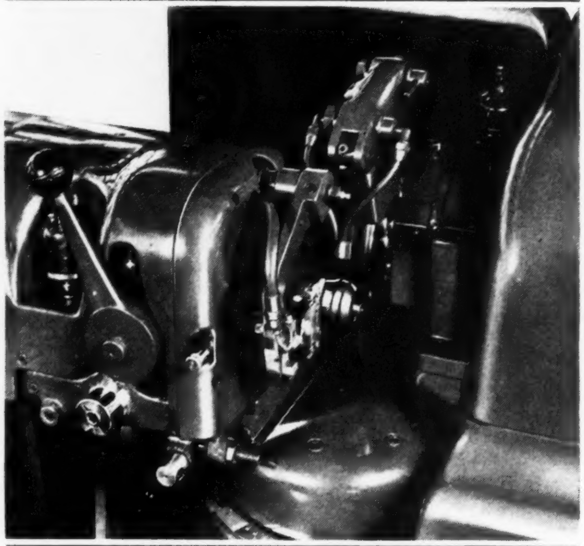


Fig. 3. Machine Shown in Fig. 1 Equipped for Grinding External Raceways

rapidly between two adjustable stops for grinding double-row races. Thus both raceways can be ground at the same setting.

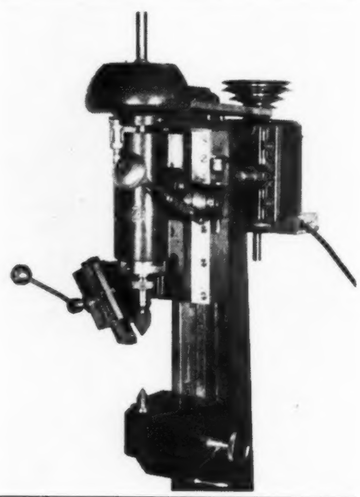
The wheel-base is moved into and out of the grinding position by a crank motion. On the internal grinding machine, a cam motion is combined with the crank motion to obtain the cross-wise movement of the wheel into and out of the race. A hydraulic motor actuates these two motions, producing rapid, yet smooth acceleration and deceleration. The anti-friction bearing wheel-spindle is located within an octagon-shaped slide, four sides of which are utilized as bearing surfaces. The machine is so arranged that it can be made to spark out either "dry" or "wet." Provisions are made to permit connecting the machine with a central coolant system. A coolant supply unit which can be located on the floor at the side of the machine can be supplied when required.

Separate compartments in the machine base house the various mechanisms, such as the electric control panel and the sizing device controls. For safety, the compartment doors covering the electric controls are so arranged that they break the entire electric circuit when they are opened. The weight of the machine is approximately 4800 pounds, and it occupies a floor space of 47 to 52 inches. 51

Ex-Cell-O Center-Lapping Machine for Tool-Room Use

A center-lapping machine consisting essentially of a cast-iron base and column, a motor-driven high-speed ball-bearing spindle carrying the abrasive stone, an adjustable work-rest, and a dressing device has been brought out by the Ex-Cell-O Corporation, Detroit, Mich. This machine will lap centers on work up to 8 inches in diameter and up to 36 inches in length that is to be ground on centers. One end of the work is placed on a vertically adjustable center that can be positioned quickly by means of a hand-crank. After the work is located, the lapping stone spindle is lowered to lap the center on the upper end of the work.

Two four-step pulleys are provided for changing spindle speeds, the spindle being driven from the motor through a V-belt. A spindle speed of 5000 revolutions per minute is normally employed. A floating spline bushing is interposed between the spindle pulley and the spindle proper to prevent belt tension from being transmitted to the spindle shaft. The spindle housing is mounted on balls in hardened and ground V-ways, and is operated vertically by means of a hand-lever. The entire assembly is counterweighted to provide maximum sensitivity. The diamond dresser for the lapping stone is mounted in a fixed 60-degree angular position on the column of the machine, and is moved across the abrasive stone by means of the dresser handle. 52



Ex-Cell-O Machine for Lapping Centers

To obtain additional information on equipment described on this page, see lower part of page 124.

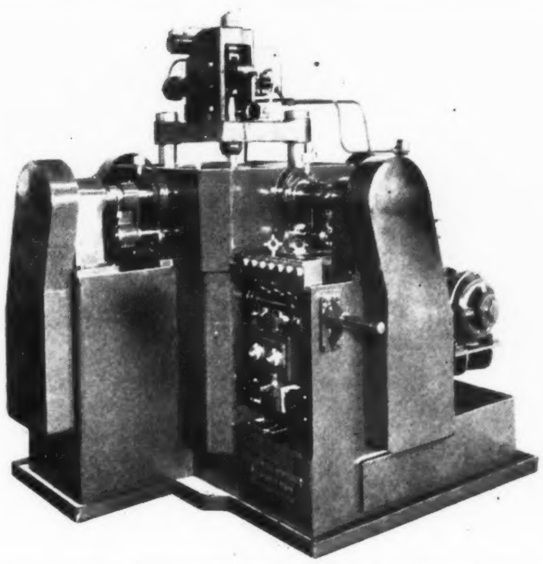


Fig. 1. Reed-Prentice Four-way Machine

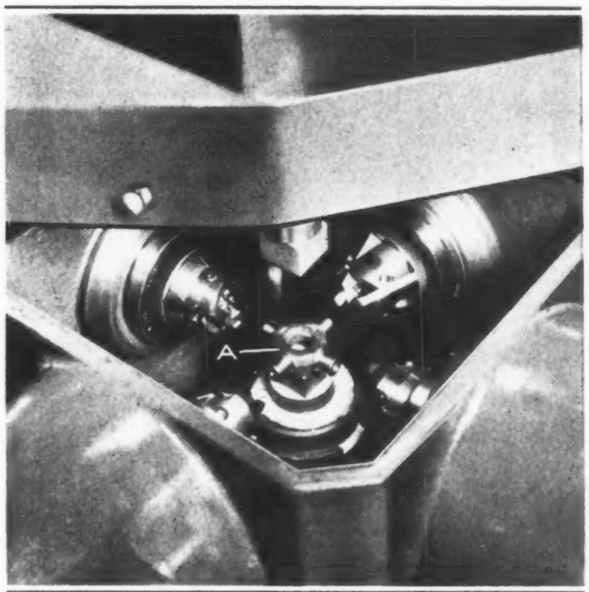


Fig. 2. Close-up View of Machine Shown in Fig. 1

Reed-Prentice Four-Way Machine for Turning Universal-Joint Spiders

The Reed-Prentice Corporation, Worcester, Mass., has recently brought out the four-way machine shown in Fig. 1 for turning, chamfering, facing, centering, and drilling universal-joint spiders, such as shown at *A*, Fig. 2. The four spindles, spaced 90 degrees apart, have electrically controlled hydraulically operated rapid-approach and rapid-return movements. The fixture is also hydraulically operated. When the machining operations have been completed, the work-holding clamp is automatically released and raised to the position shown in Fig. 2 to allow the operator to remove the finished spider.

The spindles are mounted in Timken roller bearings, the thrust loads being taken by ball thrust bearings. Each spindle is driven independently by a three-horsepower motor having a speed of 1200 revolutions per minute, which gives a spindle speed of 500 revolutions per minute. The feeds range from 0.008 to 0.028 inch per revolution. The rapid approach through the hydraulic feed requires only 2 1/2 seconds, and the loading time is only 1 3/5 seconds. A complete operation, consisting of turning, chamfering, facing, and centering, is performed in approximately twenty seconds. The machine is furnished with a motor-driven coolant pump and ample facilities for chip removal. 53

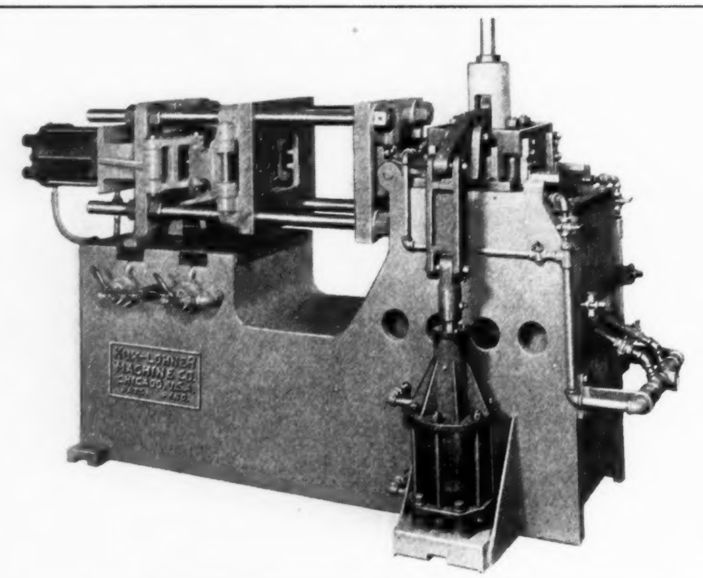
Thomson Spot-Welder

A spot-welder designed to handle the medium duty range of work in sheet-metal welding shops has been placed on the market by the Thomson-Gibb Electric Welding Co., 170 Pleasant St., Lynn, Mass. This machine, known as Model B, is of simple design and does not require an experienced operator. Both pressure and current are applied by operating the foot-treadle which actuates the upper welding arm. The length of time the welding current flows is determined entirely by the speed with which the foot-treadle is operated. An automatic timer is recommended for work requiring very accurate timing. The welding pressure can be adjusted up to approximately 200 pounds.

The machine is available with throat depths of 8, 12, and 18 inches, and with transformer capacities of 10, 15, and 20 kilovolt-amperes which permit welding two thicknesses of clean mild steel ranging from 10 to 17 gage, depending on the kilovolt-ampere rating and throat depth of the machine. The welding current is controlled by means of a heavy-duty double-pole switch which is suitable for use on 220- or 440-volt lines. This switch is mounted on the back bar at the rear of the machine, and cannot be closed until welding pressure is applied, provided the electrodes are properly set. 54

Thomson Model B Spot-welding Machine

To obtain additional information on equipment described on this page, see lower part of page 124.



Horizontal Die-casting Machine Brought out by the Kux-Lohner Machine Co.

Kux-Lohner Die-Casting Machine

A horizontal die-casting machine built in 12- and 18-inch sizes has been brought out by the Kux-Lohner Machine Co., 2147 Lexington St., Chicago, Ill. These machines are of compact, rigid design, built to withstand the high pressures developed in this class of work. All structural members are of steel. All parts subjected to wear and strain are of heat-treated alloy steel.

The hydraulic machines are furnished as complete self-contained units. A five-horsepower motor-driven hydraulic pump produces the pressure required for operating the various rams. A high-pressure gas accumulator bottle, which functions to intensify the speed of the "shot" cylinder, is also incorporated in the machine.

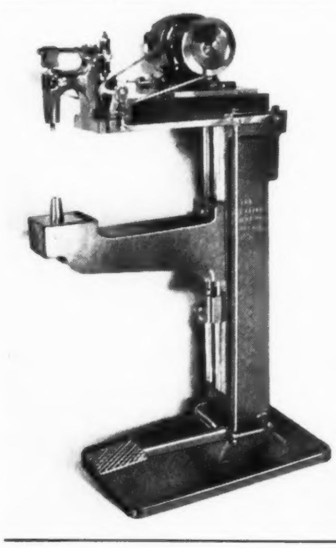
The hydraulic pressure can be changed in a few minutes to suit the castings being made. Plunger pressures up to 2000 pounds per square inch for injecting the molten metal into the die are possible. With these high pressures, sound and strong castings are produced which are true to size. Safety features have been incorporated whereby each phase of the casting cycle must be completed before the next one can start.

Patented improvements incorporated in the machine include a plunger that is designed to take up wear, is non-sticking, and retains its ability to hold pressure; a furnace and metal pot so designed that no strain is put on these members, a massive bridge construction being used to support the plunger gooseneck; and a core-pulling mechanism that can be placed in any position around the dies and is claimed to save from 25 to 40 per cent on die costs. Cores of any length from zero to the maximum length desired can be pulled at any angle. Safety provisions make it impossible for a "shot" to be made until the dies are closed. Interlocking valves insure operation of the machine in proper sequence. The machine illustrated is arranged for air operation, but it is also built for hydraulic operation with a self-contained, motor-driven hydraulic pump and built-in accumulator bottle for rapid injection of molten metal. The volume of metal per "shot," including the gate, ranges up to 8 pounds of zinc for the smaller machine and 10 pounds of zinc for the larger one. 55

High-Speed Wide-Gap Riveting Hammer

The High Speed Hammer Co., 333 Norton St., Rochester, N. Y., now makes ten different sizes of riveting hammers with horizontal gaps of sufficient depth to accommodate approximately 90 per cent of all work to be riveted. These machines cover a cold riveting range up to 1 1/2-inch solid rivets. In order to meet the increasing demand for machines adapted for riveting parts in which the rivets are located a great distance from the edge of the work, this company is gradually extending its line of wide-gap, high-speed hammers. The latest additions to this line are the No. 1AA and the No. 1 1/2B sizes. These machines have a capacity range for handling mild-steel rivets up to 1/8 inch. While the standard gap of these machines is only 3 inches, the machine illustrated has a horizontal gap of 18 inches, and machines with even wider gaps can be furnished if desired.

All movable parts of these hammers are interchangeable with standard hammers of the same size. Wide-gap hammers are used for riveting turbine blades or buckets into a complete wheel assembly. Machines



High-Speed Riveting Hammer with 18-inch Gap

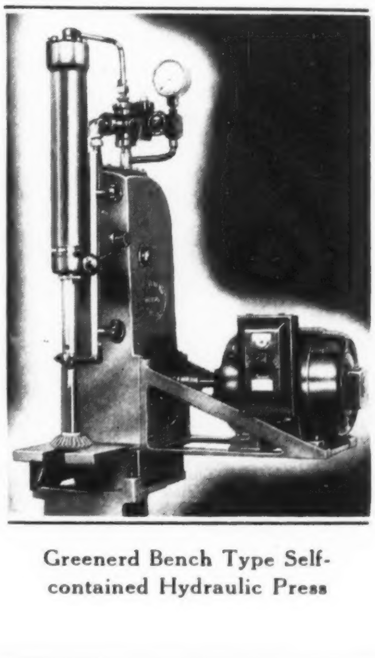
To obtain additional information on equipment described on this page, see lower part of page 124.

of this type are also used for riveting wagon wheels, fire doors, agricultural machinery, aviation parts, and many other parts of a similar nature. 56

Greenerd Bench Type Hydraulic Press

The Greenerd Arbor Press Co., Nashua, N. H., has recently developed a 1 1/2-ton, self-contained hydraulic bench type arbor press for production pressing, broaching, assembling, and burnishing operations. The press is cast in one unit of semi-steel, and the pump and control valve are mounted in the oil sump, which is part of the main housing. The pump shaft is directly coupled to the two- or three-horsepower motor.

The ram is put in motion by a hand-lever and will maintain pressure on the work until the lever is released, when the ram automatically returns to the upper position predetermined by the setting of the power stop. The table on which the work is mounted is 8 by 8 inches and has a 2-inch slot. The press is made in six types, having ram movements of 12 and 14 inches and down speeds ranging from 140 to 275 inches per minute under full load, and up speeds from 322 to 788 inches per minute under no load. The pressure can be set from 50 pounds to 1 1/2 tons. 57



Greenerd Bench Type Self-contained Hydraulic Press

Ex-Cell-O Thread Grinder for Grinding Threads up to 22 Inches in Length

Ex-Cell-O Thread Grinder for Long Threads

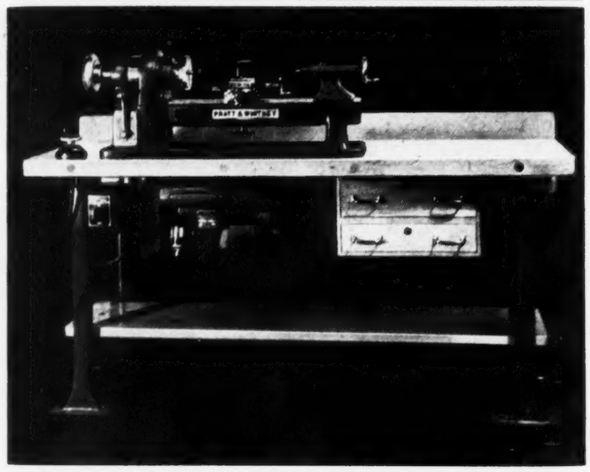
To facilitate the production grinding of long threads on parts such as airplane landing gear strut tubes, machine tool feed-screws, lead-screws, etc., the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich., has added to its line the new thread grinder here illustrated. This machine is modeled after the new standard No. 31 production thread grinder, but is of larger capacity. It will grind threads up to 22 inches in length on work up to 36 inches long between centers. Straight threads can be ground on work up to 6 inches in diameter, and the taper attachment will handle work up to 5 inches in diameter.

The new model has a long master lead-screw enclosed in a housing extending beyond the left side of the grinder, the work-carrying table being designed to feed to the right of the machine. The short lead-screws used on the standard No. 31 machine can also be employed on the new machine. The work-table is supported on a sub-base, and rides on hardened, ground, and lapped steel rollers.

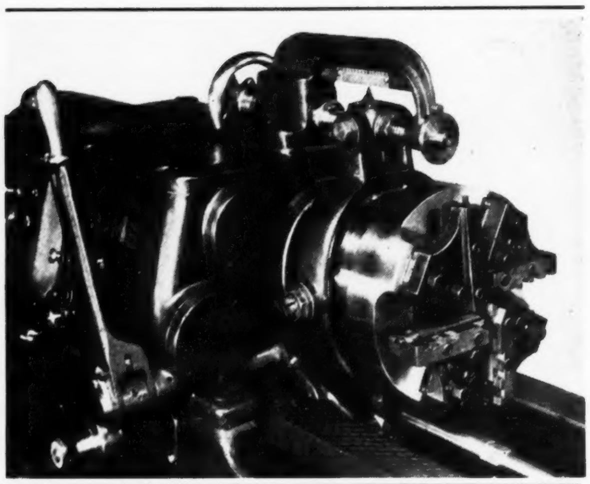
The lead-screw spindle is supported at the table end in two precision bearings, and is driven by a two-speed motor through worm-gearing. The machine is designed to grind in both directions. Wheels can be dressed without slowing them down. Two-step interchangeable pulleys for both wheel- and motor-spindles are furnished with the machine, making it possible to maintain the same surface grinding speed, within 3 per cent, as the grinding wheel wears down from the original 18-inch size to a minimum diameter of 12 inches. The machine can be especially equipped with direct-current motors and a 24-step rheostat, which gives speed variations of from 1485 to 2640 revolutions per minute.

The machine can be set either to stop or to reverse automatically at the end of each stroke. Independent controls from the front of the machine provide for starting and stopping both the wheel-head and the coolant-pump motor; for selecting fast or slow table movements in either or both directions, with a right-hand or a left-hand lead-screw; for reversing the machine wiring for left- or right-hand lead-screws; and for starting and stopping the work-table. An emergency stop-button for shutting down the entire machine is also provided. 58

To obtain additional information on equipment described on this page, see lower part of page 124.



Pratt & Whitney Bench Lathe Available with or without Bench and Bench Equipment



Acme Dial Micrometer for Setting Threading Dies to Correct Pitch Diameter

Pratt & Whitney Bench Lathes

A cam-lock spindle nose that provides exceptional rigidity in holding the chuck or faceplate on the spindle with no possibility of its being thrown off when the spindle is stopped suddenly is a feature of two new bench lathes brought out by the Pratt & Whitney, Division Niles-Bement-Pond Co., Hartford, Conn. These new bench lathes are designed primarily for precision work in tool-rooms and experimental laboratories, where their universal features and adaptability make them particularly suited for a wide variety of applications on many small parts necessary in tool-room, gage, and model work. These features can also be used to advantage on production work for certain classes of light precision manufacturing operations.

Aside from size and capacity —7 by 16 inches and 10 by 20 inches—these two bench lathes are very much alike. The accurate spindles are mounted on preloaded super-precision ball bearings, permanently lubricated and sealed. The Transitorq drive, through multiple V-belts, provides smooth even performance with an infinite number of spindle speeds within its range. The tailstock spindles are graduated for drilling to exact depths. Speed changes are obtained by simply turning a graduated knob. A great variety of interchangeable precision attachments are available for use on these lathes.

The smaller machine has a bed length of 33 1/2 inches; maximum center-to-center distance, 16 inches; swing over bed, 7 inches in diameter; and collet capacity, 3/4 inch. The larger machine has a bed 44 inches in length; center-to-center distance, 20 inches, swing over bed, 10 inches in diameter; and collet capacity, 1 inch. The spindle speeds, with a one-half horsepower motor, range from 150 to 1500 revolutions per minute for both machines; with a three-quarter horsepower motor, from 225 to 2250 revolutions per minute. The smaller machine weighs about 305 pounds, and the larger machine, 385 pounds. 59

Acme Dial Micrometer for Setting Threading Dies

A dial micrometer for setting tangent threading dies to the correct pitch diameter within 0.001 inch without stopping the machine is a feature of the improved line of Model 35 threading machines built by the Acme Machinery Co., 4533 St. Clair Ave., Cleveland, Ohio. Another new feature is the double adjusting screw which permits the operator of the threading machine to take one or any desired number of roughing cuts on coarse-pitch threads before taking the correct finishing cut, the setting for which is not changed or disturbed in any way during the roughing cuts.

The new threading machines are equipped with Acme tangent die-heads designed for higher cutting speeds, longer die life, and greater chip clearance. These dies consist of two principal parts, the die ring and the barrel. The die-holders are drop-forged, and are rigidly bolted and doweled to hardened and ground steel die slides, which prevents the dies from springing open under heavy cuts, with resulting inaccuracy of the work.

Eight spindle speeds are obtained through a selective type gear-box. An accurate lead-screw drive for the carriage and a pitch indicator are also provided. All shafts are mounted on preloaded anti-friction bearings, and all headstock gears and bushings are lubricated by an automatic flood system. The particular threading machine illustrated is built in single, double, triple, and quadruple units to take work up to 2 inches in diameter. Other machines of this type are built to handle work up to 6 inches in diameter. 60

To obtain additional information on equipment described on this page, see lower part of page 124.

Oilgear 40-Ton Twin Riveting Press

Right-hand and left-hand front spring seats and steering knuckle support arms are riveted together on a 40-ton twin press and fixture designed and built by the Oilgear Co., 1302 W. Bruce St., Milwaukee, Wis. Two 20-ton vertical cylinders, 5 13/16 inches between centers and connected in parallel, upset two 3/8-inch cold rivets simultaneously to complete the assembly.

In operation, the semi-assembled right- or left-hand seats and arms are located in the fixture and the rivets inserted. Depressing the double push-button safety control brings the two rams downward simultaneously to force the parts solidly together against pressure pads and upset the two rivets. When a predetermined pressure sufficient to form the rivet heads has been reached, the rams return automatically to the starting position and stop. Emergency stopping and reversing buttons are mounted between the two starting buttons.

The rigid gooseneck frame, integral pump, and motor base of the press are welded into one compact piece. Both cylinders are mounted on an adapter, and sufficient clearance is provided in the frame so that the center distance can be increased if necessary. The Oilgear pump is directly connected to a 10-horsepower electric motor having a speed of 1200 revolutions per minute. This motor supplies fluid power to the twin cylinders through a solenoid-operated control valve. Adjustable pressure reversal is provided through a convenient knock-out cylinder and limit switch. The stroke length is adjustable up to a maximum of 8 inches. 61

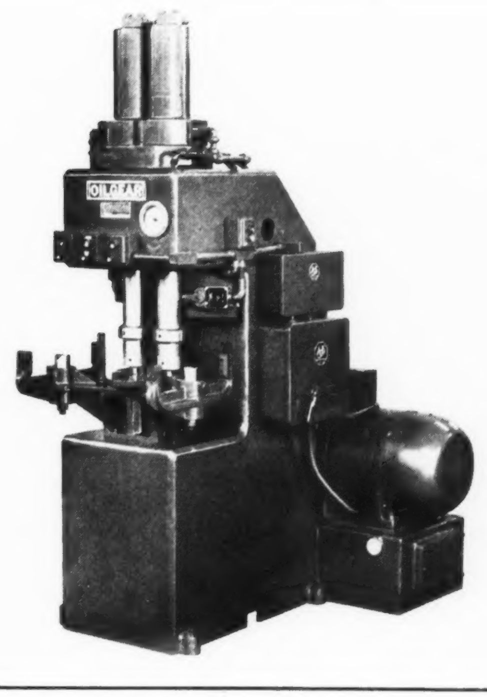
Niagara Inclinable Press for Heavy-Duty Work

A new Master Series A inclinable press, designed for heavy-duty work, has been added to the line of the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. This machine has a shaft 6 1/2 inches in diameter, and completes the company's range of Master Series presses with shaft sizes from 1 1/2 to 6 1/2 inches in diameter.

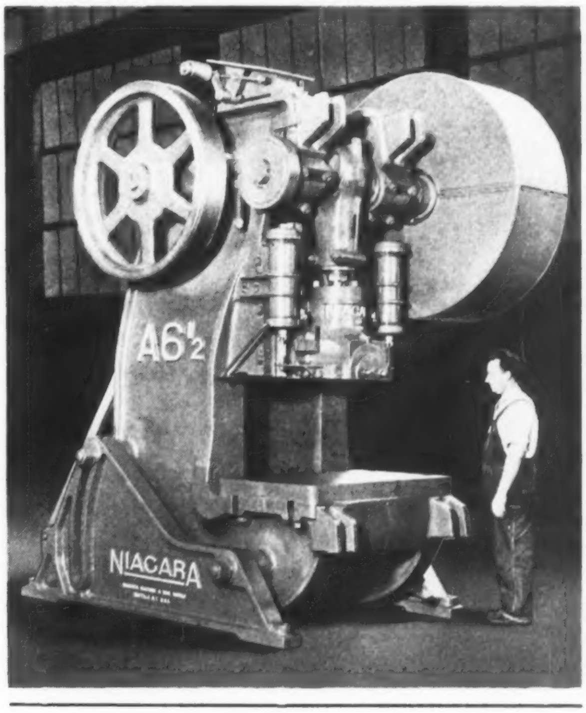
The outstanding features of this machine include two air counterbalances connected to the slide; a heavy-duty fourteen-point engagement sleeve clutch with built-in single-stroke mechanism; a rigid cast-steel frame; a one-man inclining device equipped with anti-friction bearings; adjustable and removable gibs with multiple V-ways; a breech-block die clamp; and a self-contained back-gear assembly with anti-friction bearings, mounted within the frame. The pinion and drive gear are enclosed in guards, and the main-shaft bearings are split at a 45-degree angle. Provision is made for individual motor drive. 62

Wire-Rope Clamp that Eliminates Splicing

A new wire-rope clamp that eliminates the splicing of wire rope has been developed by the Marine Specialty Co., 3178 Bellevue Ave., Detroit, Mich. This



Twin Riveting Press and Fixture Built by Oilgear Co.



Niagara Master Series A Inclinable Press

To obtain additional information on equipment described on this page, see lower part of page 124.

clamp is made from high tensile-strength manganese bronze, and is therefore rustproof. It is claimed that it will hold the wire rope with a firmness equal to the strength of the rope itself. The clamp is available in sizes of from 1/8 to 1 inch. 63

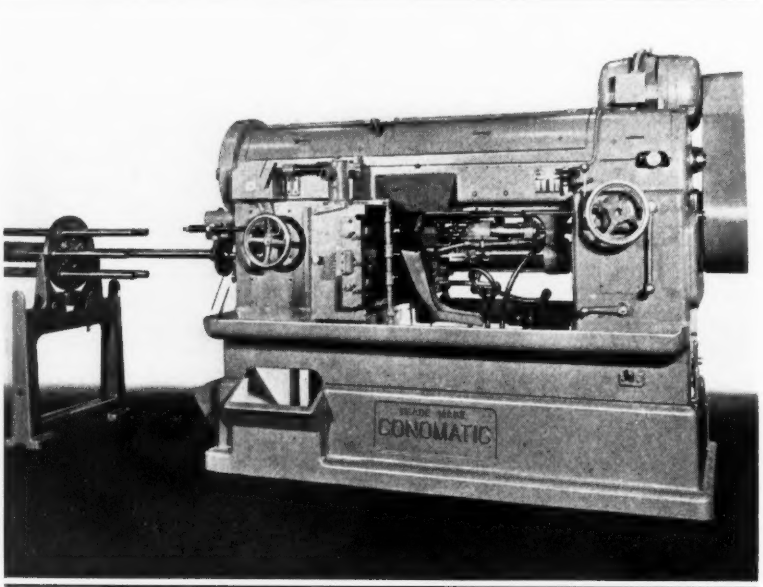
Six-Spindle "Conomatic"

Important improvements have been incorporated in the new line of six-spindle "Conomatics" brought out by the Cone Automatic Machine Co., Inc., Windsor, Vt. One of the most outstanding is the design of the attachment-driving mechanism. Open-end gearing is now available, and the time required for placing any attachment in operation is reduced to a minimum. The high- and low-speed cam action can be disconnected by the operator when checking tools. Power-feed engagement is instantaneous, obtained by a touch of the lever, and can be controlled from either side of the machine.

The power-feed countershaft provides a very wide range of feeds and a slow speed for tooling, which can be instantly moved to the high or production feed. The power-feed reverse makes the handwheel unnecessary and lessens the time required for tooling up. Two formers and a cut-off tool are held in the front slide, while three forming tools are employed in the rear slide.

Six end-working positions are provided by the cylindrical turret, and two independent end positions are furnished by the semi-turret. The stock arm is so actuated that all rebound of the stock is eliminated. Two independent end stations are provided by the auxiliary spindle attachments.

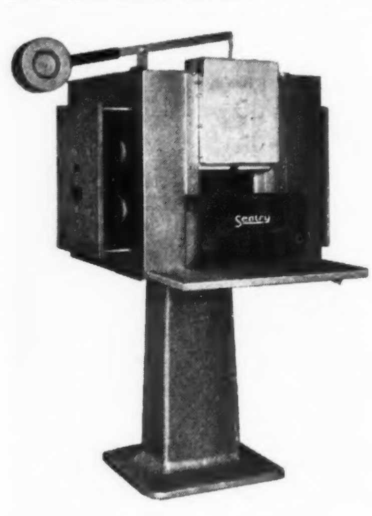
High-speed drilling, reaming, threading, and tapping are all provided for, as well as roll-turning, knee-turning, roll-supporting, and forming. Universal auxiliary cross-slides are easily attached to the top bed for operation in the fifth and sixth positions. Refinements have been made in the indexing mechanism, and care has been taken to reduce wear and noise. 64



Six-spindle "Conomatic" of Improved Design

Sentry Electric Furnace

A new No. 3 Model Y electric furnace designed for hardening fairly large, high-speed steel tools has been brought out by the Sentry Co., Foxboro, Mass. This furnace will be shown for the first time at the National Metal Exposition to be held in Detroit, Mich., October 17 to 21. The new furnace is similar in design to the No. 2 Model Y described and illustrated in October, 1936, MACHINERY, page 163, but has about twice the production capacity of the latter machine.



Electric Furnace for Hardening High-speed Steel Tools

The muffle is 8 7/8 inches wide, 4 inches high, and 16 inches deep, and will accommodate most of the standard sizes of "Diamond Blocks" used with the Sentry Diamond Block method of atmospheric control. With this method, tools of maximum hardness and cutting performance can be produced without scaling, decarburizing, or reduction in size. 65

Independent Portable Electric Grinders

Three new portable electric grinders for wheels having diameters of 4, 5, and 6 inches have been placed on the market by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. These grinders are all provided with the Thor shock-absorbing spindle to prevent vibration from reaching the motor.

To obtain additional information on equipment described on this page, see lower part of page 124.

This construction helps to prevent burn-outs and production delays, and saves repair costs.

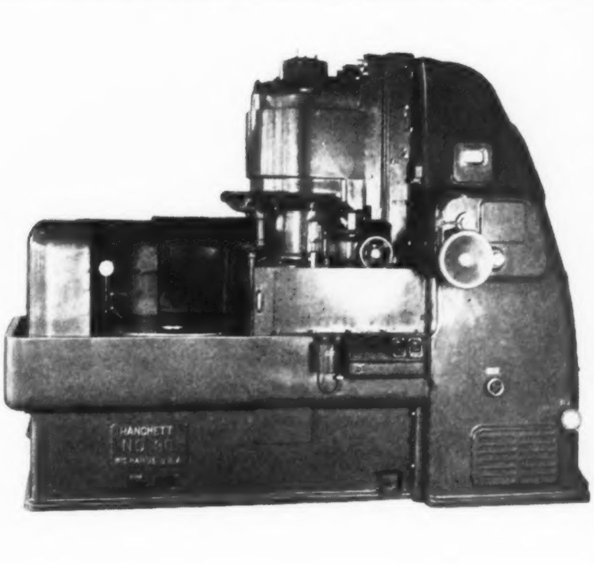
The 4-inch grinder, known as Thor U54, is recommended for fast grinding on light jobs. It weighs 10 pounds and operates at a free speed of 6000 revolutions per minute. The 5-inch grinder, Thor U55, is intended for heavier work. It weighs 10 1/4 pounds and runs at 4500 revolutions per minute. The 6-inch grinder, Thor U60, is designed for the very heaviest kind of grinding work. It weighs 20 pounds and has a speed of 6000 revolutions per minute. 66

Hanchett Rotary Surface Grinder

A No. 36 surface grinder with a rotary work-table mounted on a horizontal slide which has rapid power traverse forward and back from the grinding wheel has just been placed on the market by the Hanchett Mfg. Co., Big Rapids, Mich. This machine will handle work up to 30 inches in diameter when equipped with a 30-inch table, and work up to 36 inches in diameter can be accommodated when a 36-inch table is used.

The Walker magnetic chuck type table used has a speed range of from 6 to 36 revolutions per minute. The wheel-head has hand and automatic variable feed ranging from 0.004 to 0.080 inch per minute. The feed-wheel is graduated in steps of 0.0001 inch. There is a separate motor for rapid power raising and lowering of the head which is interlocked with the wheel feed. The coolant is pumped through the center of the grinding wheel and also through a nozzle outside of the wheel. The coolant reservoir in the bed of the machine has a capacity of 175 gallons.

An Ames work-measuring gage is mounted in a dustproof case supported on an adjustable bracket. The grinding wheel is driven by either a 25- or a 30-horsepower motor operating at a speed of 700 revolutions per minute. The revolving rotary magnetic chuck is driven by a three-horsepower motor, the table traverse by a 1 1/2-horsepower motor and the raising and lowering feed of the head by a two-horsepower motor. The automatic wheel feed is driven by a 1/4-horsepower gear reduction motor, and a 3/4-horsepower motor is employed to drive the coolant pump. The machine is 5 feet 8 inches wide, 10 feet 8 inches in length, and weighs approximately 15,000 pounds. 67



Hanchett Surface Grinder with Rotary Table

Combination Metallurgical Microscope and Photographic Camera

"Metaphot" Combination Metallurgical Microscope and Camera

The George Scherr Co., 124 Lafayette St., New York City, has announced that the new Busch "Metaphot" will be demonstrated at the National Metal Exposition in Detroit, October 17 to 21 at Booth A-445. The "Metaphot" is a metallurgical microscope of radically new design, being a combination of microscope and photographic camera, assembled into one permanently aligned unit.

Instead of bellows, the camera is equipped with the new patented "Vario-Ocular," a device that changes the magnification of any eye-piece optically, at the turn of a dial. Therefore, the ground glass remains always in the same fixed position in front of the observer. The continuous series of magnification obtained thereby is desirable when definite magnifications are needed. For instance, exactly 100 diameters for grain size estimations or examinations of inclusions in steel can be obtained. Other standard magnifications of 200, 500, 1000, and 2000 diameters are also easily available.

The "Metaphot" is designed to meet the requirements of the shop and testing room. It takes

To obtain additional information on equipment described on this page, see lower part of page 124.

less desk space than a typewriter, and is shock- and dust-proof. All parts are in proper alignment, and only minor adjustments are required when photographs are to be made. The lamp house can be tilted for inspection of machined or finished surfaces.

The stage of the microscope is of the inverted type and accommodates polished or fractured specimens of any size or shape. The type of illumination can be changed instantly from bright field to dark field, vertical or oblique illumination. 68

Oliver Drill-Pointing Machine

The Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich., has just brought out a new 510 drill-pointing machine embodying many improvements which are the result of fifteen years' experience with the older type machine. With this new machine, the drill is held in a rotating chuck and each lip is presented to the grinding wheel in rotation. Clearance is provided by an oscillating motion of the grinding wheel, controlled by a cam.

The drill-holding chuck is mounted on a swivel base and permits grinding the points to an included angle of from 82 to 160 degrees. A variable cam gives four different clearance angles to the cutting edge. A combination of the variable point angle and the variable clearance provides the correct cutting point for the new types of steel and other metals.

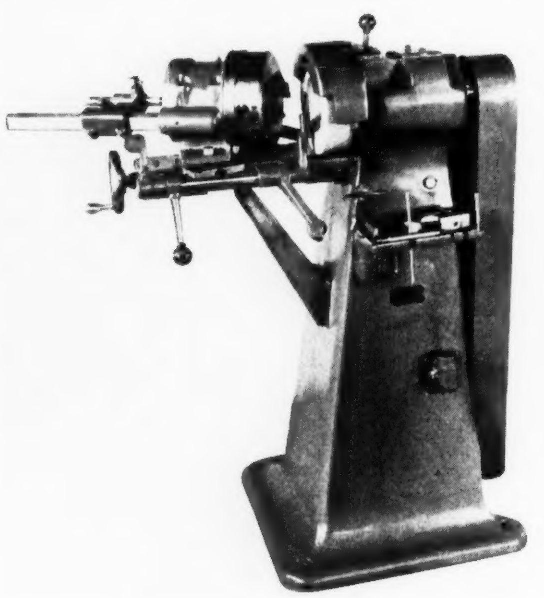
The chuck drive is controlled through a positive clutch instead of the friction clutch formerly employed, and all shafts, except the chuck and quill, are equipped with anti-friction bearings. The wheel-spindle has Timken precision roller bearings. The machine is made in only one size, with a capacity for grinding all drills from 1/4 inch to 3 inches in diameter. It is regularly equipped for grinding drills having two, three, and four flutes, and is made in two styles for wet and dry grinding. 69

Precision Lathe Grinder

A new precision lathe grinder, designated Model HLGE, has been placed on the market by the United States Electrical Tool Co., Cincinnati, Ohio. This ball-bearing precision grinder is intended as a production tool for external and internal grinding. Speeds up to 30,000 revolutions per minute, obtained by using pulleys of various sizes, adapt the grinder to a wide variety of work. The motor housing is cast iron and is pivoted on a cast-iron base.

A spring-actuated plunger between the motor and the base keeps the belt at the proper tension. Radial and vertical adjustment of the tool are provided for through T-bolt mounting. This grinder can be mounted on lathes, planers, shapers, and boring machines. It can be used in a vertical or a horizontal position. The belt guard is held in place by wing-nuts, and can be adjusted to accommodate the various pulley combinations.

The universal motor operates on direct or alternating current. The toggle switch is mounted on the motor housing. A fan is included in the cooling system and there is an air cleaner in the motor housing. 70



Drill-pointing Machine Brought out by Oliver Instrument Co.

Precision Lathe Grinder Made by the United States Electrical Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 124.

Shaw Blueprint Machine with Washing and Drying Attachments

The Model M machine built by the Shaw Blue Print Machine Co., Inc., 9-11 Campbell St., Newark, N. J., for making blueprints, blue-line prints and vandyke negatives, described in October, 1937, MACHINERY, page 152, is now equipped with washing, potashing, and drying attachments. The illustration shows the printing machine with the three units assembled for continuous operation. This complete assembly occupies a floor space 65 inches wide by 101 inches deep. It will make prints on paper or cloth up to 42 inches in width at a speed ranging from 9 inches to 12 lineal feet per minute.

The washing unit receives the exposed prints when they leave the printing unit. As the prints enter the top of the washer they receive the first water wash for removing chemicals. From the washing unit they enter the potash bath, and then receive a second water wash, after which they continue down a long inclined drop to a large tray at the bottom of the washer, where they receive a continued puddle bath. The prints, as they leave the lower wash tray, proceed upward for a distance of 24 inches. This permits some of the surface water to drain back into the tray before the prints enter the two wringer rollers.

Finally, the prints enter the drying unit, where they pass around the surface of two revolving copper drums heated by either gas or electricity. Two felt-covered rollers, which have an ironing effect, cause the prints to leave the dryer in a smooth, shiny condition. From this point, the prints travel over two gripper rollers to a winding roller, after which they are ready for the shearing operation. 71

Two-Spindle Precision Boring Machine

A two-spindle precision boring machine designed for machining a variety of miscellaneous parts of the same general type has been developed by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich. A spindle head is mounted at each end of the machine with the work-holding fixture between. The machine illustrated is set up for boring, facing, and chamfering the end frame of a motor. The boring operation is performed with the boring-bar at the right-hand end of the machine, while facing and chamfering are done with the boring-bar at the left-hand end, the fixture being fed to one bar and then to the other.

The motor end frames are set on a locating rabbet, and the two hinged clamps are swung into position and tightened. The spindle speed for the boring tool is considerably higher than for the facing and chamfering operation, the former also having a finer feed (0.0015 inch) for high finish on babbitt. The average production rate is 44 pieces per hour. 72

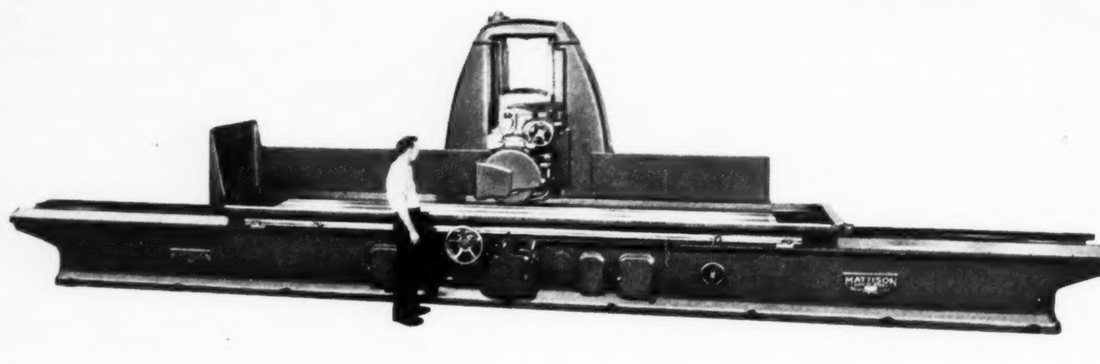
Fillet Welding Electrode

The Metal & Thermit Corporation, 120 Broadway, New York City, has made an addition to its line of Murex heavy coated electrodes for manual arc welding. The new electrode, known as Murex Fillex, is intended for fillet welding and other "downhand" work. The outstanding feature claimed for the electrode is low cost of the deposited metal. It is also said to permit welding operators to increase their output appreciably. 73

Shaw Continuous Blueprinting Machine with Washing and Drying Attachments

Ex-Cell-O Precision Boring Machine with Two Opposed Spindles

To obtain additional information on equipment described on this page, see lower part of page 124.



Mattison Precision Surface Grinder Built for Use in a Railroad Shop

Mattison Precision Surface Grinder of Large Size

The precision surface grinder here illustrated is believed to be one of the largest of its type ever built. It was completed recently by the Mattison Machine Works, Rockford, Ill., for use in a railroad shop. The table is 30 inches wide by 16 feet long. The length of the base is 36 feet, and the clearance between the wheel and the table is 20 inches.

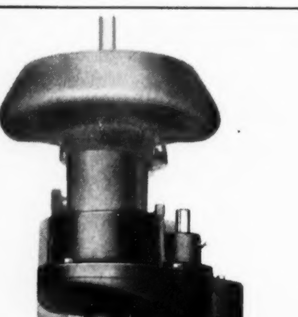
The table surface of this machine is of sufficient size to accommodate large work which could not previously be handled satisfactorily. The machine produces an accurate and fine finish, and in addition, permits grinding more pieces per set-up on regular size work. 74

Buffalo Power-Feed Drilling Machine

A positive gear-driven power feed is the outstanding feature of the No. 16 drilling machine recently added to the line of the Buffalo Forge Co., Buffalo, N. Y. This machine is built in a pedestal type, with one spindle or with any number of spindles in line up to six, and in a bench type with any number of spindles from one to four. It can also be had in straight-line multiple-spindle combinations with the No. 16 sensitive drilling machine spindles. The spindle nose of the power-driven machine has a No. 2 Morse taper.

Either a 1/3-, 1/2-, or 3/4-horsepower motor operating at 1140 revolutions per minute can be used to give drilling capacities of 3/8, 5/8, and 3/4 inch, respectively. The distance from the center of the spindle to the column is 8 1/4 inches, and the vertical travel of the spindle is 6 inches. Spindle speeds of 265, 460, 750, 1200, and 2000 are available. The three positive power feeds are 0.003, 0.007, and 0.011 inch.

The clutch type power feed is engaged by a feeding motion of the handle, and is disengaged by an upward movement of the handle. The feed-clutch cam is held out of engagement by spring pressure, but in such a manner that the spindle quill can be run up or down by hand until the drill meets the work, when the resistance thus met engages the power feed. When the drill has been advanced to the required depth, it is stopped by a pin on the indicator dial. The feed is automatically disengaged at the end of the maximum travel, and in addition, a shear pin is provided to protect the feeding mechanism.



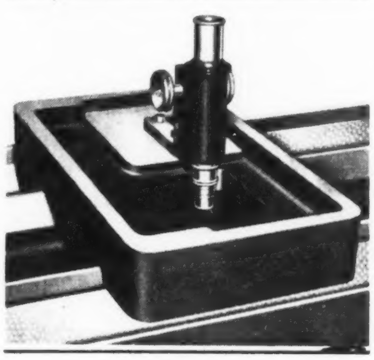
Buffalo Drilling Machine with Gear-driven Power Feed

The hand-feed lever at the left enables the operator to shift instantly from power to hand feed without disturbing the depth stop adjustment. This hand feed can be replaced with an automatic tapping arrangement. The right-hand control has a bolt latch whereby the feed can be locked to permit sensitive drilling. 75

Linley Bench Milling Machine Mounted on Cabinet Base

The high-speed vertical bench milling machine made by the Linley Bros. Co., 14 Montauk St., Bridgeport, Conn., which was described in the June number of MACHINERY, page 720, is now available in a floor model, the machine being mounted on a cabinet base with a hinged door at the front. Shelves in the cabinet provide convenient storage space for tools. 76

To obtain additional information on equipment described on this page, see lower part of page 124.



Instrument for Aligning Machine Beds

Microscope-Equipped Instrument for Aligning Grinding Machine Beds

An aligning instrument provided with a microscope, designed specifically for aligning the long beds of Cincinnati grinding machines, has been brought out by Cincinnati Grinders Incorporated, Cincinnati, Ohio. This instrument consists of a cast-iron platen having vee and flat bearing surfaces that are duplicates of the table bearing surfaces. Thus it will be guided in the same path as the machine table.

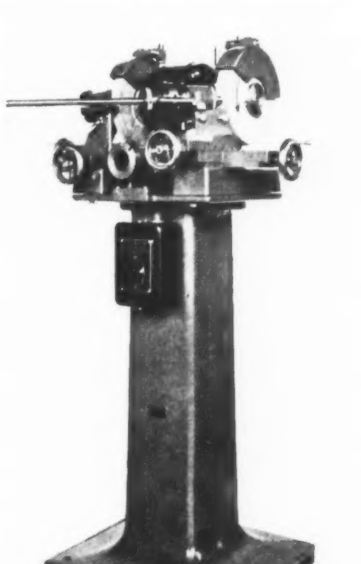
Mounted on the platen of the instrument is a microscope having an accurately divided scale across the optical field. This scale, which has 0.0005 inch graduations, indicates the deviation of the V-way from a straight line when readings are taken at regular intervals on the same side of a wire stretched tightly from one end of the machine bed to the other.

White paper placed under the wire at the reading intervals and a light bulb on an extension cord can be used to facilitate the taking of accurate readings. A new length of wire should be used for each test to avoid any possibility of an error being introduced by the wire. A reel of steel music wire, 0.022 inch in diameter and approximately 750 feet long, is included with each aligning instrument. This method of checking alignments, commonly known as a "wire test," provides an exceedingly close check on the basic straight-line table motion of center type grinders. It has the advantage of giving the measured errors directly, thus permitting positive correction. 77

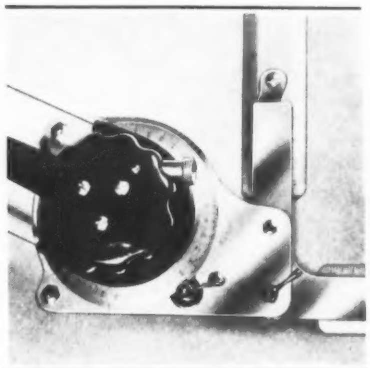
Wells Deep-Hole Drill Sharpener

A machine for dressing the points of single-lip, straight, V-fluted oil-hole drills used for drilling rifle barrels, machine spindles, and other deep-hole work is being placed on the market by the Wells Mfg. Co., 55 Pawtucket Ave., Rumford, R. I. This machine makes it possible to sharpen the points of any number of drills to the same angle, thus eliminating the non-uniformity resulting from hand grinding.

Indicators permit setting the machine for grinding different angles or for duplicating the angles ground on a previously dressed drill point. The machine has a capacity for sharpening drills up to 0.700 inch in diameter. It is equipped with a 1/4-horsepower electric motor for operation on single-phase 60-cycle, 110-volt circuits. 78



Wells Sharpening Machine for Deep-hole Drills



Head of Bruning-Wallace "Touch Control" Drafter

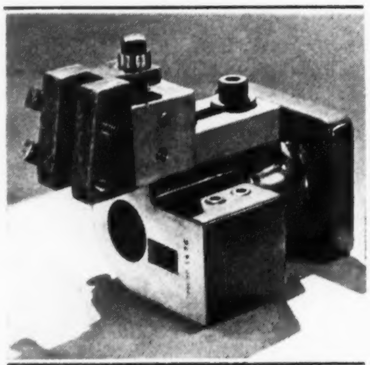
"Touch Control" Drafting Machine

The Charles Bruning Co., 100 Reade St., New York City, has just brought out the Bruning-Wallace "Touch Control" drafter designed to enable drawings to be made with greater speed and accuracy. The "touch-control" button for the protractor head is conveniently located under the draftsman's thumb on the protractor head. A touch on this control button releases the head, allowing it to rotate freely to the desired setting. Simply lifting the thumb locks the head positively at the desired automatic indexing stop. A slight turn of the control button allows "free wheeling," enabling the head to rotate freely.

This new drafting machine is designed especially for the use of mechanical, architectural, and structural draftsmen. The full-circle protractor is graduated throughout in degrees, and numbered in each quadrant from 0 to 90 degrees. Automatic indexing stops are provided at 0, 30, 45, 60, and 90 degrees in each of the four quadrants, corresponding to standard triangles, and the double vernier reads to 5 minutes. The scale line-up adjustment permits the scale to be set accurately to lines previously drawn instead of lining up the drawing to the scale.

A new civil engineer's drafter, designed for map draftsmen and navigators, has also been developed and a counterbalanced drafter with "touch control" is available for vertical boards. 79

To obtain additional information on equipment described on this page, see lower part of page 124.



Gisholt Turning, Boring, and Facing Tool for Turret Lathes

Combination Turning, Boring and Facing Tool

The combination turning, boring, and facing tool here illustrated is being placed on the market by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. With this tool, it is possible, through the use of forming tools, to machine work to a radius or any other desired shape while boring and facing or turning. In a typical turret lathe set-up for machining 2-inch bearing support bushings, two combination turning, boring, and facing tools are used. The first tool rough-bores, rough-turns, and rough-faces the bushing, while the second tool finish-bores, finish-turns, and finish-faces it. The floor-to-floor time required to machine this piece is 4.2 minutes.

The tool permits a variety of operations to be performed simultaneously. The exact diameter size is obtained through the use of a micrometer screw. A special block can be inserted under the adjustable turning arm to increase the turning capacity to any desired diameter.

Drills, boring-bars, and facing bars can be held in the center hole. All cuts taken by the tool are held in exact relation to one another, and the concentricity between bored and turned surfaces is accurately maintained. This tool is bolted to the turret face, and is made for the Gisholt Nos. 3, 4, and 5 ram type universal turret lathes and other turret lathes of a similar type. 80

Huge Keller Automatic for Producing Automobile Body Dies

Heavy dies for the production of very large automobile body stampings can be made on a huge new Keller automatic tool-room machine having a cutting range of 12 by 6 feet, which has been completed recently by Pratt & Whitney, Division Niles-Bement-Pond Co., Hartford, Conn. This machine is similar in design to the Keller Type BG-3 automatic machine, but it embodies a number of refinements that add to its flexibility. The combined weight of the machine and its fixture is 155,000 pounds.

As in the previous Keller machines, the work and the model are bolted to a fixture located vertically on a stationary table. The column moves horizontally along the machine bed, the saddle travels vertically, and the entire head of the machine moves transversely on the saddle. The head carries the cutter-spindle, and above it, an electric tracer which controls the machine motions through magnetic clutches.

In three-dimensional die work, such as machining automobile body dies and punches, the machine is set to operate automatically, requiring no guidance from the operator. The operator rides on a platform attached to the saddle of the machine, from which position he can control, through push-buttons and levers, any motion and make every operating adjustment.

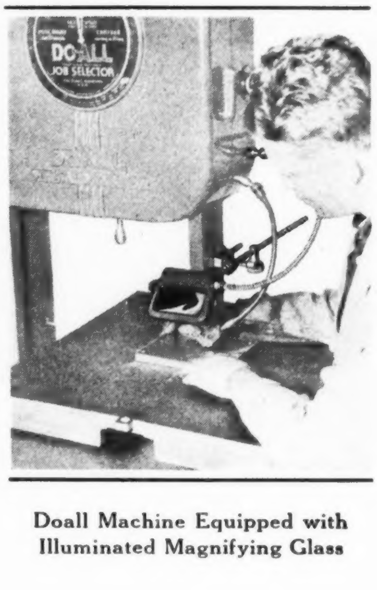
An important element of the machine is the magnetic gear-box, through which the horizontal travel of the column and the vertical travel of the head are effected. Two adjustable-speed motors furnish the drive to this gear-box. The gear-box contains the magnetic clutches by means of which the gears are shifted and the direction of the horizontal and vertical motions are selected. In the previous BG-3 machine, both motions operated at the same speed, whereas in the present machine, the two motions are effected independently, thereby increasing the operating flexibility.

From his position at the head of the machine, the operator can energize any one of four gear selector clutches for each motion and thereby choose the one that will drive the two directional clutches. Energizing of the directional clutches can be accomplished by push-button, but when the machine is under tracer control, it is effected automatically. Further adjustment of speed is possible by rheostat control of the gear-box motor.

A similar magnetic gear-box effects the transverse motion of the spindle head. In this case, however, there are two selective speed magnets, driven by an adjustable-speed motor. The spindle is driven by a 10-horsepower adjustable-speed motor. Spindle speeds are changed by three levers within easy reach of the operator. 81

Illuminated Magnifying Glass for Doall Machine

A two-power magnifying glass enclosed in the same fixture as a 15-watt electric lamp is being manufactured by Continental Machine Specialties, Inc., 1301-7 Washington Ave., S., Minneapolis, Minn., for use on Doall equipment when sawing and filing work to a lay-out line. The lamp connections can be plugged into any standard electric socket. The complete unit can also be used at



Doall Machine Equipped with Illuminated Magnifying Glass

To obtain additional information on equipment described on this page, see lower part of page 124.

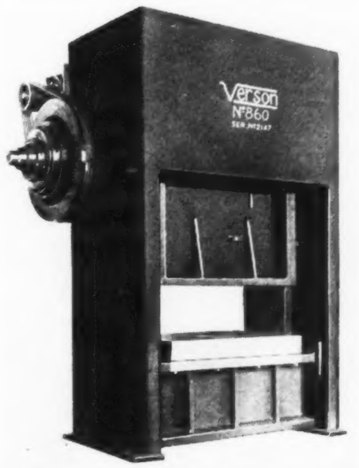
the inspection bench or at any point where a magnifying glass is required.

The 2- by 3 3/4-inch lens permits clear vision for both eyes. The lamp is provided with a ball-joint holder and can be clamped to the guide post, as shown. 82

Verson Allsteel Full-Eccentric Press

The Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill., has developed a new line of presses having capacities ranging from 100 tons to 500 tons. The accompanying illustration shows a 300-ton capacity, full-eccentric press. The distance between the housings of this press is 60 inches and is the same as the distance between the gibs. The ram adjusting motor is contained within the ram plates, yet is readily accessible for lubrication and inspection.

The frame of the press is of all-steel welded construction, and all moving parts except the flywheel and clutch are contained within the crown. The clutch is air-actuated, and the disk type friction brake operates in unison with the clutch. These presses are available in the solid-frame type shown, in both single- and double-suspension types. Tie-rod frame machines with one-, two-, and four-point suspension are also available. 83

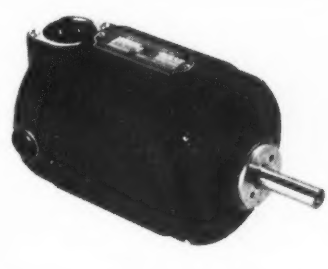


Verson Allsteel 300-ton Full-eccentric Press

Dumore Fractional-Horsepower Motors

The Dumore Co., Racine, Wis., has recently brought out two fractional-horsepower motors designed for a variety of high-speed applications requiring accurately balanced armatures. These motors, designated Types W and W2, are the largest and most powerful of the Dumore line. They are also among the most efficient and lightest per horsepower. They have high-precision grease-sealed ball bearings, mounted in steel sleeves molded in the aluminum housings. Preloading springs eliminate end play and compensate for wear.

These motors are of the plain series universal type operating on 115-volt alternating or direct current and having a varying speed characteristic. The Type W motor has a full-load speed of 6500 revolutions per minute, and a no-load speed of 15,000 revolutions per minute when operating on either alternating or direct current. When operating on alternating current, the output is 1/3 horsepower and when operating on direct current 1/2 horsepower. The motors will operate at full-load continuous duty.



Dumore Type W Fractional-horsepower Motor

The Type W2 motor has a full-load speed of 8000 revolutions per minute, and a no-load speed of 18,000 revolutions per minute. It is designed for continuous full-load duty. These motors are particularly adapted for operating lathe grinders, drill presses, centrifuges, blowers, and flexible shaft tools. 84

Ross Solenoid-controlled Air Valve

Air Control Valves

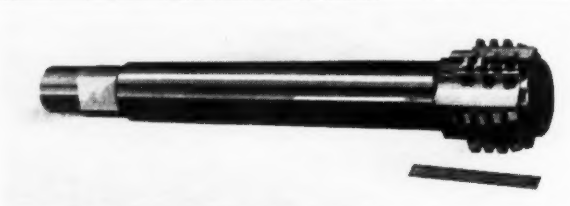
Two new solenoid-controlled air valves have been placed on the market by the Ross Operating Valve Co., 6494 Epworth Blvd., Detroit, Mich. Both valve units are especially designed for high-speed service, such as is required for welding operations. One of the units is intended for the control of single-acting cylinders, and the other for double-acting cylinders.

The valves are made in 3/8-inch pipe size, and are available for use with all standard electric currents. Air line pressure is employed for reversing the valve action. Elimination of return springs makes possible the use of smaller solenoids. The valve or solenoid can be removed by loosening four bolts. 85

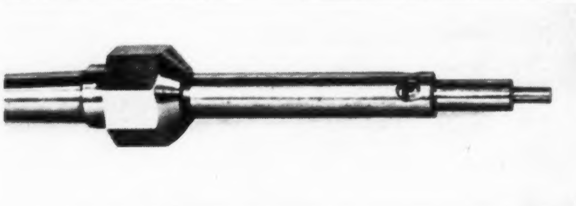
Cup-Point Set-Screws with Knurled Points

Cup-point set-screws with knurling around the points can now be supplied in a wide range of sizes by the Standard Pressed Steel Co., Box 22, Jenkintown, Pa. When screwed into place, the knurled edges effectively grip the shaft in such a manner that loosening or backing off is impossible, except by the use of a wrench. As these screws cannot harm the threads of the tapped holes in any way, it is possible to remove and insert them in the same holes repeatedly, with the assurance that they will always have the self-locking action. 86

To obtain additional information on equipment described on this page, see lower part of page 124.



Landis Special Tap for Finishing and Sizing 5-inch Thread



Center Finder for Use in Setting up Work for Precision Machining

Landis Special 5-Inch Tap

A special 5-inch tap with replaceable chasers has been developed recently by the Landis Machine Co., Waynesboro, Pa. This tap is intended for use with special die-heads made by this company for producing the screw mechanism designed to operate the control gates of a large dam.

This special tap will be used for finishing and sizing operations after the threads have been roughed out on a lathe. The thread is of the Acme form, 5 inches in diameter, 2/3 inch pitch, 1 1/3 inch lead, with a depth of 0.346 inch. Comparison of the tap with the 6-inch scale shown in the accompanying illustration conveys a good idea of the coarse pitch and unusual depth of the thread.

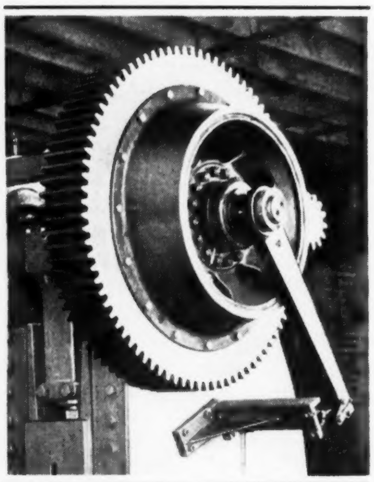
The tap body, which is 30 inches in length over all, is made of alloy steel and is precision-ground after heat-treatment. The chasers are securely locked in their correct cutting positions by means of three hollow-head set-screws. Removal of the chasers for regrinding is easily accomplished by unlocking the three retaining screws and removing the faceplate to permit sliding the chasers forward. 87

Servo-Action Friction Clutch for Punch Presses

The Industrial Clutch Co., Waukesha, Wis., has developed a Servo-action friction clutch for punch presses which is now available to press manufacturers. The principal advantages claimed for this clutch are a large increase in production, particularly in blanking, where the nature of the dies does not limit the press speed; reduced cost for repairs and time out; and a smooth easy action.

The clutch is particularly suited for application to back-geared presses, as it distributes the shock and wear evenly on the bull gear teeth. It is designed to combine shockless instant engagement and durability of the friction clutch with the positive action and simple operation of the conventional jaw or pin clutch. A punch press fitted with this clutch is operated in exactly the same way as a press using a jaw or pin clutch.

Once the clutch has been released, it cannot become accidentally engaged and thus cause unintentional repetition of the press, no matter how far the crankshaft coasts beyond the upper dead center, due to wear or improper adjustment of the brake-band. The clutch element can be temporarily connected to rotate in either direction, in order to facilitate changing or setting of the dies. 88



Punch Press Equipped with Servo-action Friction Clutch

Pierce-Beacon Electric Center Finder

The R. Y. Ferner Co., 131 State St., Boston, Mass., has recently placed on the market the Pierce-Beacon electric center finder, which has been designed to facilitate the setting up of work for precision machining operations on jig borers, milling machines, lathes, grinders, etc. This instrument consists essentially of a hollow cylindrical member having four accurately sized sections made of polished steel, which contains battery dry cells and a lamp that is visible through four circular apertures in the lower section of the body. When contact with the work and the instrument is established, the light comes on. This indication is supersensitive, and when used as a guide, permits locating work to be done with great accuracy.

The straight end of shank section is inserted in a chuck or sleeve to suit the machine on which it is to be used. When intended for use on jig borers, a taper shank for the standard draw-in rod and a hexagonal nut for accurately centering the tool on the spindle are provided. 89

South Bend Improved Adjustable Motor Drive for Lathes

A pedestal type of motor drive available for the precision lathes of 9-, 11-, 13-, 15-, and 16-inch swing built by the South Bend Lathe Works, South Bend, Ind., was illustrated and described in October, 1937, MACHINERY, page 154. Certain improvements have been introduced in this drive, in-

To obtain additional information on equipment described on this page, see lower part of page 124.

cluding a new double-arm adjustable tension brace which locks the pedestal motor drive unit rigidly in position when the lathe is in operation. Two turnbuckles, one on each arm, permit adjusting the cone pulley belt for any pulling power.......90

Knu-Vise Toggle-Action Clamps and Vises

A line of toggle-action clamps of the type shown in Fig. 1 is being placed on the market by the Knu-Vise Products Co., Detroit, Mich. These clamps are especially suitable for holding sheet-metal parts while welding, but they find numerous applications in clamping work for drilling, tapping, and similar operations that are relatively free from vibration. It is essential, however, that the work be of substantially uniform thickness, since only a slight variation in the gripping position of the clamping pad can be accommodated.

Another product recently placed on the market by this company is the quick-acting machine vise shown in Fig. 2. The two jaws which slide in the horizontal plane are opened and closed through a toggle mechanism, actuated by the lever at the rear.

Fig. 1. Knu-Vise Toggle-action Clamp

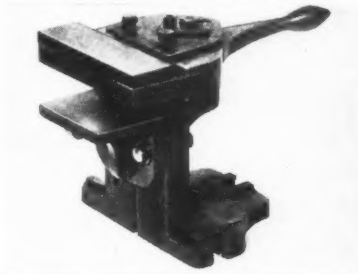


Fig. 2. Quick-acting Machine Vise

This lever is moved through an angle of only about 30 degrees when clamping or releasing the work. The maximum movement of the jaws is approximately 3/4 inch. The jaws are provided with blank inserts which can be machined to suit the work, and as both jaws more through equal distances, the work is automatically centralized, irrespective of slight dimensional variations.

An angle-plate is vertically adjustable on the machined front face of the vise body. This plate can also be tilted, if required, and serves as a stop or support for the work during the machining operation. It can also be used as a chute for directing the finished pieces as they fall from the vise jaws. In conjunction with the angle-plate, the vise forms a universal work-holding fixture for drilling, reaming, milling, assembling, or other operations. Jig plates fitted with bushings can be located and clamped on the two projecting pillars.......91

Johnson "Ledaloyl" Self-Lubricating Bearing Bronze

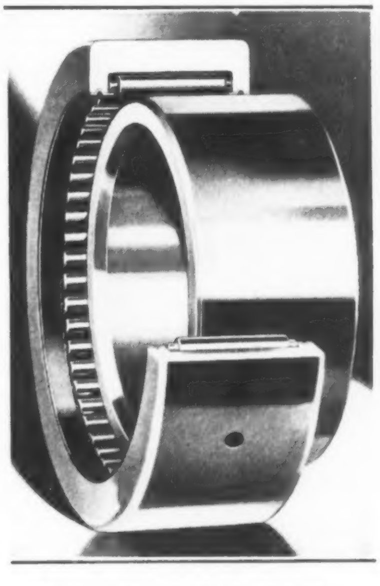
A new type of bearing material has been developed in the laboratories of the Johnson Bronze Co., 520 S. Mill St., New Castle, Pa., which involves an entirely new method of manufacturing. It is claimed that the method imparts many new, unusual, and valuable properties to the bearing material, which has been designated the Johnson "Ledaloyl" self-lubricating bearing bronze.

"Ledaloyl" can be classified primarily as a sintered type material. However, an exclusive process of pre-alloying the basic metals imparts characteristics not previously available. For instance, it permits the introduction of lead. This element eliminates harshness and provides conformability for misalignment. Likewise, pre-alloying reduces all the basic metals to one definite alloy, thus creating a uniform grain structure and a thoroughly homogeneous material.

In the manufacturing process a definite amount of volatile material is included that later produces porosity in the bearing. By submerging in vacuum tanks, the pores are filled with oil of a viscosity to suit the application—oil up to 35 per cent of the volume of the material being retained. The capillary structure of the bearing thus permits a constant flow of oil to the shaft when needed and absorption when not required. It is stated that this material will not harm the shaft or housing.......92

Bantam Heavy-Duty Needle Roller Bearing

A new type of heavy-duty needle roller bearing, known as the Standard Quill bearing, has been developed by the Bantam



Bantam Needle Roller Bearing with One-piece Outer Race

To obtain additional information on equipment described on this page, see lower part of page 124.

Bearings Corporation, South Bend, Ind. This bearing is the result of many years of experience in the manufacture of needle rollers for automotive transmissions, universal joints, Diesel engine wrist-pins, and heavy-duty machinery.

In the new bearing, the ordinary assembly of outer race members has been supplanted by a one-piece, rigid, channel-shaped outer race, in which a full complement of small-diameter rollers is firmly held. These bearings are available either with or without inner races. They are carried in stock in a complete range of sizes for shafts from 3/4 inch to 5 inches in diameter. 93

"Wyteface" Steel Tape

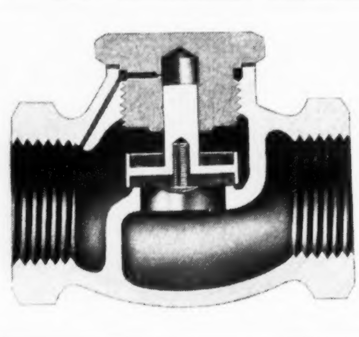
A new "Wyteface" steel tape measure designed for general use has been placed on the market by the Keuffel & Esser Co., Hoboken, N. J. This tape has black graduations on a crack-proof white surface, which can be easily read, even in poor light. Elimination of the usual etching process makes the steel tape stronger and less likely to kink or curl. The white surface is firmly bonded to the steel, thus protecting the steel from rust and corrosion.

This tape is designated "Favorite Wyteface" to distinguish it from the "Stevens Wyteface" model used by surveyors and engineers. It has a black leatherite case, nickel-plated mountings, a long folding, self-opening handle, and a patented friction brake designed to eliminate backlash. It is made in 25-, 50-, 75-, and 100-foot lengths. 94

"Wyteface" Steel Tape Designed for General Use

Norgren Check Valve

Irritating noise and damage resulting from valve hammer in air lines are said to be completely eliminated by a check valve brought out by the C. A. Norgren Co., Inc., Denver, Colo. The movable member of this check valve is made of bronze and brass bar stock, and is so constructed that it is held in suspension by the suction created above the stem by the air flowing past the syphon hole in the valve body.

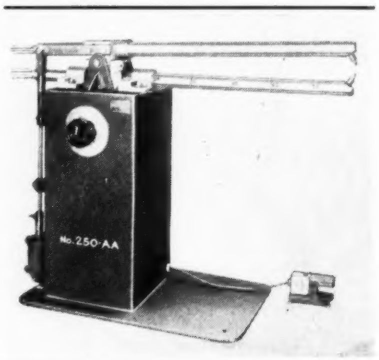


Norgren Check Valve Developed to Eliminate "Hammer"

When the compressor is operating under normal conditions, the check remains open and the air passes freely and quietly into the receiver. When the compressor stops, the vacuum above the stem is broken and the valve returns to its seat. This action serves to eliminate "hammer." The valve can be easily serviced by the simple replacement of inexpensive disks. 95

Universal Spot-Welder with Adjustable Horns

The Eisler Engineering Co., 750 S. 13th St., Newark, N. J., has recently placed on the market a universal long-horn spot-welder of 25- to 50-kilovolt-ampere capacity for deep sheet-metal work. The novel feature of the machine is that both the upper and lower welding horns can be lengthened or shortened, as required, to suit the type and size of work being handled. The horn adjustment makes it possible to weld light and heavy work and deep metal sheets.



Eisler Spot-welder with Length Adjustment for Horns

The markings on the horn represent the kilovolt-ampere ratings; for example, when the horn is placed on the 25 mark, the welder is set for a capacity of 25 kilovolt-amperes, and when the horn is readjusted to the 50 mark, it is set for a capacity of 50 kilovolt-amperes. These spot-welders are made with welding tips of many different styles. Cooling is provided by circulating water through the entire arm.

These welders are made for foot, air, or motor operation, and will weld from 30 to 150 spots per minute, depending on the type of work. They are made in three sizes covering a range of capacities from 5 to 75 kilovolt-amperes and with arm lengths of 30, 36, and 40 inches. 96

Gage for Measuring Thickness of Non-Magnetic Coatings

Measuring the thickness of a sheet of material when only one side of the sheet can be seen and reached by a measuring instrument is a problem that would baffle the mechanic used to think-

To obtain additional information on equipment described on this page, see lower part of page 124.

ing in terms of micrometer measurements. The General Electric Co., Schenectady, N. Y., has developed a device by which it is possible to measure the thickness of a coating of enamel on an object without injuring the coating, when only the outside can be reached by the measuring instrument.

The device consists of an electromagnetic thickness gage by means of which, figuratively speaking, invisible fingers of magnetic flux go groping through the enamel coating and report back the thickness of the film with a very high degree of accuracy. This instrument was originally developed for the purpose of measuring enamel coatings on refrigerator cabinets without destroying the enamel. More recently, it has been applied to measuring non-magnetic metal plating on steel or iron, insulation, and the thickness of the black coal tar enamel on large steel pipes for water supplies. 97

Metco Metallizing Gun

The Metallizing Engineering Co., Inc., 44 Whitehall St., New York City, has developed a Type E Metco metallizing gun to meet the demand for fast, reliable, and economical metallizing equipment with improved spraying characteristics. This equipment is designed to give extremely fine metal coatings at production speeds. Simplified adjustments permit continuous operation without sacrificing speed and quality. Improved nozzle and jet construction reduces gas consumption.

Metallizing Gun Made by Metallizing Engineering Co., Inc.

The metallizing gun weighs only 3 3/4 pounds, and has been designed to eliminate operator fatigue. A multiple jet turbine makes instantly available two complete speed ranges, providing all speeds necessary for commercial metals. Adequate power is available without changing gears. The equipment operates equally well on gas from acetylene tanks or generators at the maximum recommended pressure of 15 pounds. An air pressure of only 60 pounds per square inch is required. 98

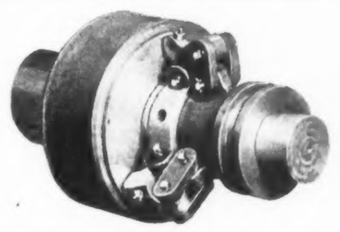


Fig. 1. "Taperoll" Clutch, Designed for Smooth Engagement

Ramsey "Taperoll" Clutch

A clutch that is designed to pick up or release the load gradually, and that can be engaged or disengaged at will, has been brought out by the Ramsey Chain Co., Inc., Albany, N. Y., in a No. 2 size for transmitting from 3 to 15 horsepower at speeds of 100 to 900 revolutions per minute. It is also made in a No. 4 size for transmitting 6 to 30 horsepower at speeds of 100 to 900 revolutions per minute. Three tapered rolls which are free to float in two directions are employed in this clutch to give the desired smooth engagement with a positive drive. These tapered rolls, when forced into engagement, do not grip instantly, but are retarded just enough to relieve the motor or other prime mover from sudden shock. Fig. 2 shows how this action is brought about.

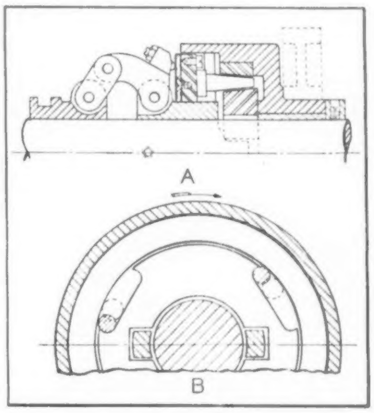


Fig. 2. Cross-sections of Clutch Shown in Fig. 1

The three hardened-steel tapered rolls are carried in a sleeve that is free to slide horizontally over a fixed hub. This sleeve is controlled by toggles connected to a sliding collar, which, in turn, is actuated by a standard shift collar and a suitably pivoted lever for operating the clutch. The toggles provide efficient engagement and lock automatically to hold the sleeve in the operating position.

The rolls are moved forward from the disengaged positions shown at *A* and *B*, Fig. 2, to engage three recesses formed on the outer rim of a floating ring, so that they gradually wedge themselves between the ring and inner conical surface of the clutch body. The rolls then rotate as they gradually pick up the load, and finally assume the position indicated by the dotted circles in view *B*, Fig. 2. When the rolls are firmly wedged in place, they stop rotating; the full load is taken up, and with the sleeve locked in full engagement, the clutch remains positively locked until it is intentionally disengaged. 99

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According to *Railroad Data*, on July 1 this year, there were over 10,800 air-conditioned passenger cars in operation on the railroads of the United States, an increase of approximately 1400 during the last year.

To obtain additional information on equipment described on this page, see lower part of page 124.

A. G. Christie, New President of the A. S. M. E.

A. G. Christie, consulting engineer and professor of mechanical engineering at Johns Hopkins University, Baltimore, Md., has been elected president of the American Society of Mechanical Engineers for the year 1938-1939. Professor Christie is well known internationally for his work in the design of power plants.

He was born in Manchester, Ontario, Canada, in 1880, and graduated from the School of Practical Science, University of Toronto, in 1901. Immediately upon his graduation, he started his engineering career as a mechanic in the East Pittsburgh, Pa., plant of the Westinghouse Electric & Mfg. Co., subsequently becoming erecting and test engineer. He was in charge of the Westinghouse turbine and gas engine exhibits of the World's Fair in St. Louis, Mo., in 1904. Following this, he became an instructor in mechanical engineering at Cornell University, but within a year returned to industry and took charge of erection, tests, and operation of the first steam turbine built by the Allis-Chalmers Co., also working on condensers, steam engines, gas engines, and pumps.

In 1907, he became mechanical engineer in charge of construction and operation of the power plant of the Western Canada Cement & Coal Co. In 1909, he became assistant professor of steam and gas engineering at the University of Wisconsin, and in 1914, he joined Johns Hopkins University as associate professor, becoming professor in 1920.

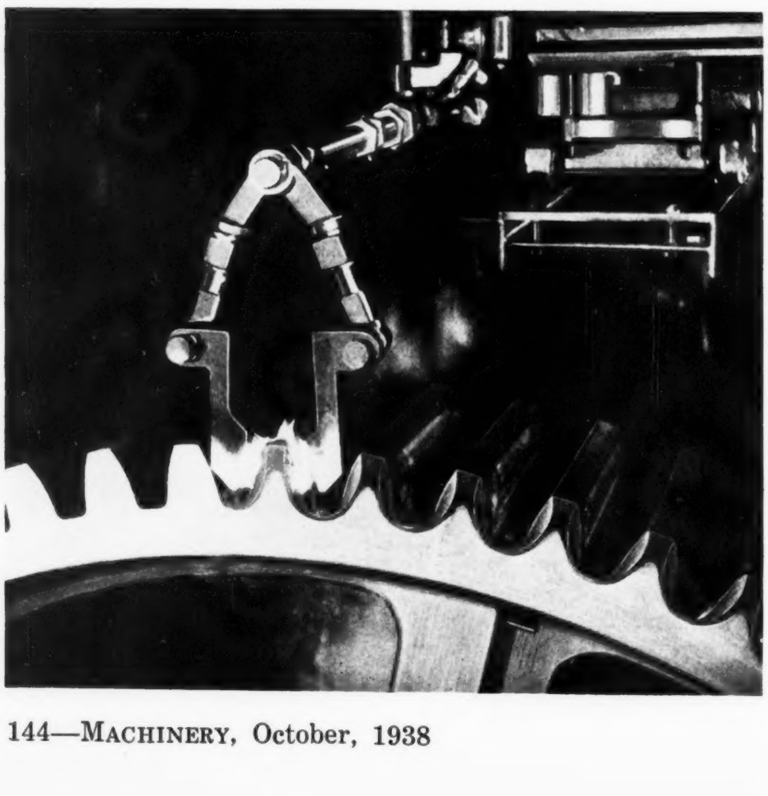
In addition to his academic work, Professor Christie has acted as consulting engineer on a great many power plant projects in the United States and Canada, as well as in many countries abroad, including Great Britain, Germany, Sweden, Switzerland, France, Denmark, Argentina, Asia, and Australia.

Professor Christie has been a member of the American Society of Mechanical Engineers since 1907. He has been a member of various committees on Power Test Codes and is today vice-chairman of the Standing Committee on Power Test Codes. He has also served on the Society's committees on publications and professional conduct. He was a member of the Council of the Society from 1922 to 1927, being a vice-president from 1925 to 1927.

As an authority on steam turbine and power plant equipment, Professor Christie has written many articles for technical journals here and abroad. He is the author of the steam turbine section of Sterling's "Marine Engineers' Handbook" and Kent's "Mechanical Engineers' Handbook."

* * *

According to the Association of American Railroads, due to the financial conditions and low ebb of traffic, railroad purchases of equipment, materials and supplies, except fuel, in the first three months of this year were 65 per cent less than in the same period of 1937.



A Flame Hardening Operation that will be Demonstrated at the National Metal Exposition in Detroit during the Third Week of October. An Airco Radiagraph, Made by the Air Reduction Sales Co., New York City, which is Especially Adaptable to Work of This Kind, is Being Employed